Heating Piping & Air Conditioning

JUNE 1957

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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

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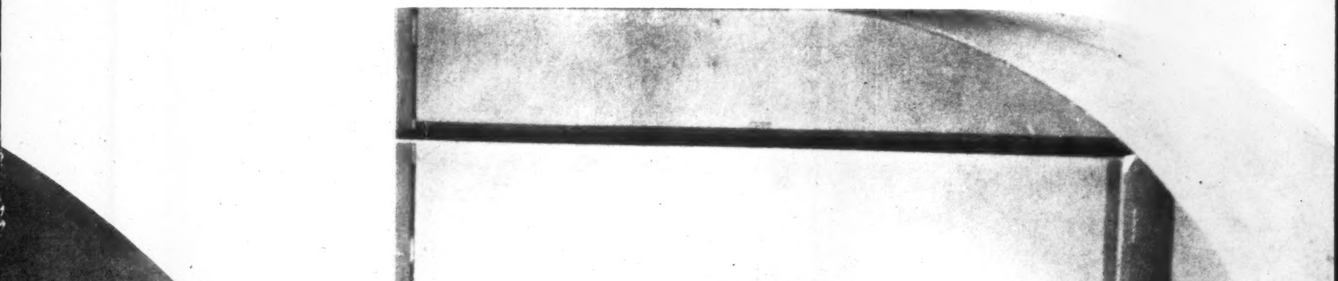

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How GRINNELL insures the accuracy of its pipe fittings

The accuracy and uniformity that is built into Grinnell pipe fittings starts at the pattern shop. Here, pattern makers, highly skilled from many years of experience with Grinnell products, painstakingly machine the pattern models — the first step in producing a top quality fitting.

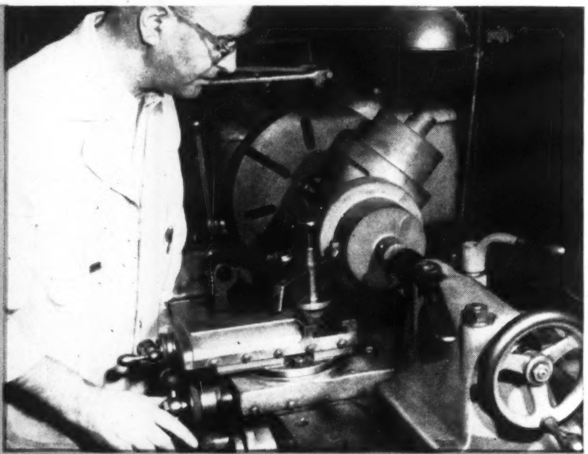
These craftsmen also make the precision core box to the same exacting tolerances as the pattern. Perfectly matched to each other, the core made from the core box and the mold made from the pattern produce the exceptionally accurate casting.

Special machines, designed and custom-built by Grinnell engineers and tool room experts, complete the machining of the Grinnell fitting.

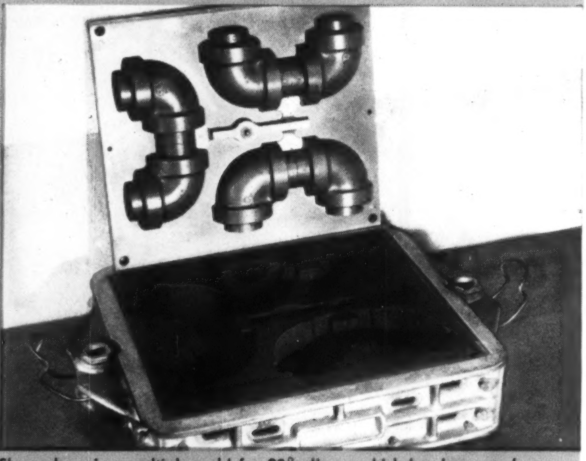
Other outstanding features of Grinnell fittings include: high quality metal; smooth surfaces inside and out; proper chamfer for easy starting and protection of first thread; precision threads for easy running up and tight joints; exact angles; and tested strength. Order a supply from your local Grinnell Distributor.

GRINNELL

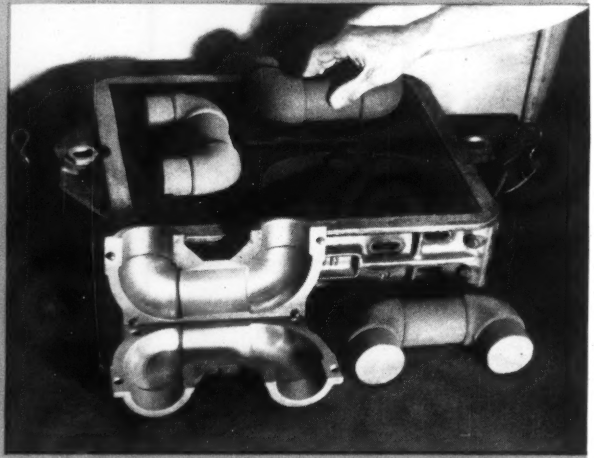
WHENEVER PIPING IS INVOLVED



One of Grinnell's highly skilled pattern makers machines the model for a 90° elbow.



Shown here is a multiple mold for 90° elbows which has been made from the pattern above it.



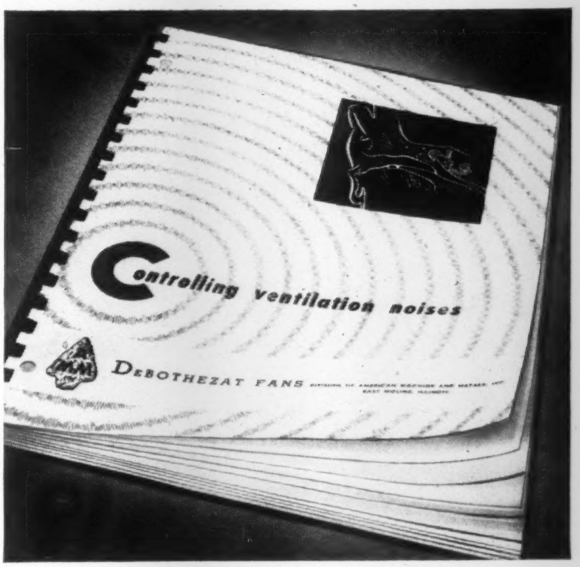
In the foreground is the precision core-box and core made in it. In the background, cores are being placed in the mold.

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

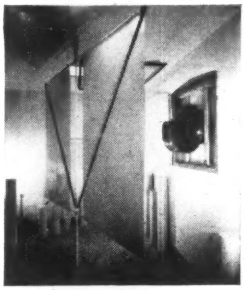
At last, authoritative research shows the way to

Predict and Reduce Fan Noise!



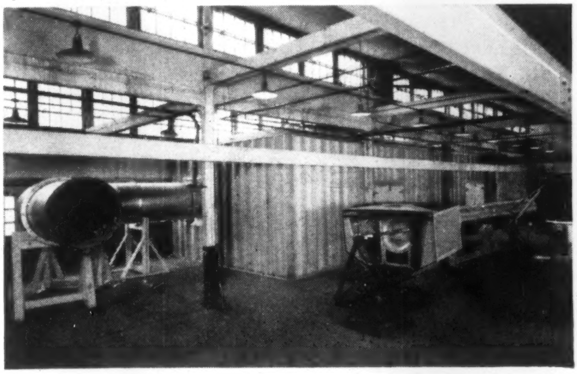
DeBothezat now offers this new 50 page book on noise control . . . anyone can use it to predict and reduce ventilating fan noise in every installation.

You need this new book, "Controlling Ventilation Noises," if you ever have *anything* to do with specifying or installing fans. This book simplifies the unfamiliar, specialized terminology of the acoustical engineer — as well as the methods for solving noise problems — so that the entire data can be put to practical use in the plant. It covers installations indoors as well as outdoors.



DeBothezat Centrifugal Roof Ventilator undergoing standard noise source calibration tests at Armour Research Foundation's acoustical laboratories.

This data is entirely new. Nothing like it has ever before been available to the industry. The book is a result of noise control research recently completed by the acoustics staff of the Armour Research Foundation of Illinois Institute of Technology.



Exterior view air outlet end of DeBothezat noise evaluation reverberation test rooms. Mock-up engine cooling test equipment in the foreground.

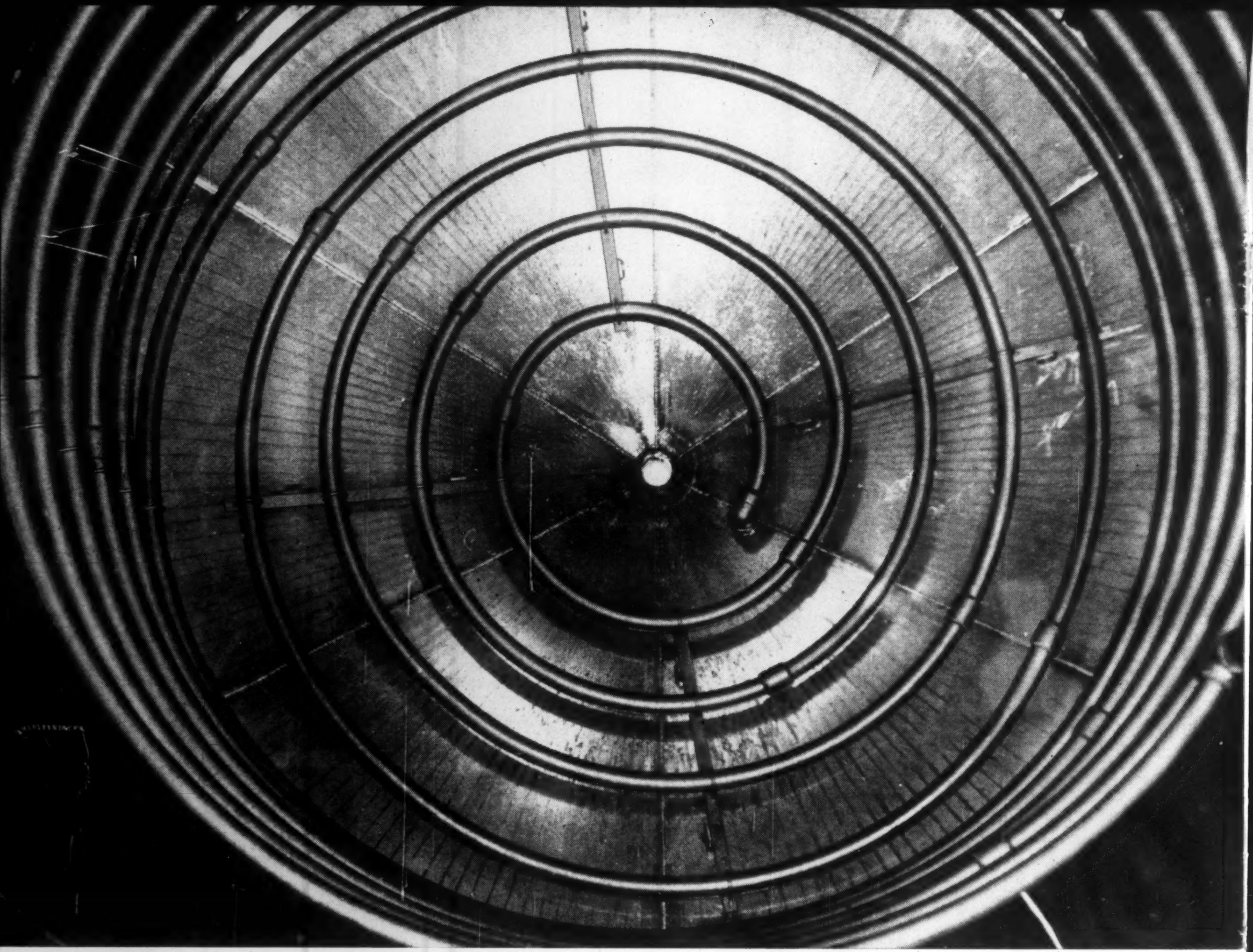
To supplement the research performed at Armour Research Foundation, which was sponsored by the DeBothezat Fans Division, DeBothezat has constructed its own noise-evaluation laboratories. These include reverberation rooms designed and calibrated for DeBothezat by Armour.

The entire noise evaluation project was sponsored by DeBothezat as a contribution to industry. It was accomplished at a cost of over $20,000 including the research at Armour and the facilities installed in DeBothezat's laboratories.

DeBothezat's facilities are now being used (1) to *obtain* accurate sound-output data on fan units, (2) to *develop* new fans with lower noise levels, and (3) to allow *publishing* of reliable sound-output data. In fact, DeBothezat fans are now rated for noise on both the inlet and outlet sides. These ratings are expressed in decibels and give the average sound pressure levels in each of 8 octave bands of frequencies, measured separately. This information is available on *all* DeBothezat fan units. They are the only fan units in the industry so rated.

The helpful 50-page book "Controlling Ventilation Noises," is available for just $2.00 prepaid to help defray costs of printing and handling. With it, anyone can predict and reduce ventilating fan noise in every installation. Request your copy on your business letterhead and attach check or two one-dollar bills.

De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
Dept. HP-657, EAST MOLINE, ILLINOIS



This processing tank employs wrought iron pipe for heating coils. Excellent bending properties, as well as corrosion resistance, lead to wrought iron's selection for this installation.

Wrought Iron Pipe's ductility permits speedy bending and stretching without rupturing the metal

Readily bent and formed, hot or cold, wrought iron pipe's high-purity base and fibrous structure assure little or no "springback."

Evidence of wrought iron pipe's excellent bending properties is the extensive use of the material for heating coils, refrigeration coils and air brake piping where short radius bends are necessary. You can tack on the corrosion and fatigue resisting properties of the material, too, for its acceptance in these applications. Our technical bulletin, *The Bending and Flanging of Wrought Iron Pipe,* shows how to produce uniformly superior results. Write for a copy. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

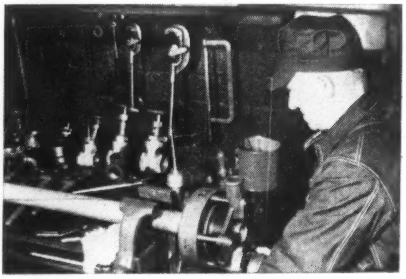
Available in Canada and throughout the world

◀ EASY TO WELD

Wrought iron produces sound welds by any of the commonly used processes because it is self-fluxing. Complete line of wrought iron welding fittings for pipe is available in sizes ¼" to 12".

EASY TO THREAD ▶

The machining and threading properties of wrought iron pipe are excellent. The uniform structure of the metal contributes to smooth, sharp threads.



BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 29 No. 6

(With which is merged the Aerologist)

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AND MAINTENANCE IN
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AND PUBLIC BUILDINGS

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One of a series.

An Inside Peek at Steam Trap Capacity Ratings

or . . . how to be sure steam heated equipment is going to work the way it's engineered

WHEN YOU GET all through engineering a steam heated process equipment installation, its performance will depend on whether your steam traps will do what the catalog said.

Now, in theory, if you know the size of a steam trap orifice, you can figure how much water can be pushed through it in a given time by a given steam pressure. But, in practice, this doesn't work out. The picture is scrambled by things like the choking effect of flash steam and restriction of flow through the trap and piping.

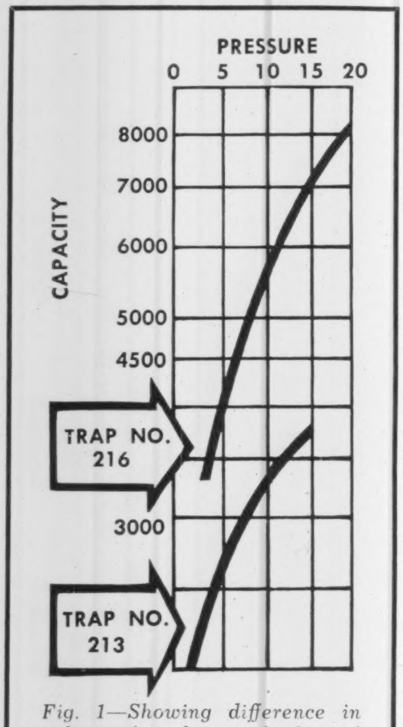


Fig. 1—Showing difference in volume of condensate discharged by a No. 216 trap with 2″ pipe connections and a No. 213 trap with ¾″ pipe connections—each trap having ½″ discharge orifice.

For example, Fig. 1 shows that a ½″ orifice in a 125 psi No. 216 Armstrong steam trap with 2″ pipe connections will discharge 7200 lb/hr condensate at 15 psi inlet pressure. Yet, a ½″ orifice in a 15 psi No. 213 trap with ¾″ pipe connections, discharges but 3900 lb/hr at 15 psi inlet pressure. The difference: pipe friction.

Thus, we see a need for investigating the basis for steam trap capacity ratings. Unfortunately, they are not all arrived at in the same way. If they are based on cold water tests, producing no flash steam, they are much too high. Orifice tests are also too high because they ignore pipe friction. Calculations involving flow-through-orifice formulae have never been known to be conservative insofar as traps are concerned.

Armstrong Ratings

Armstrong trap capacity ratings are based on actual operating conditions, determined by hundreds of tests. In these tests condensate at the steam temperature corresponding to test pressure was used. Restriction of flow caused by the choking effect of flash steam, as well as the back pressure created by flash steam and condensate, automatically were taken into account. Actual installation hookups were used, so that pipe friction in both inlet and discharge lines also was reflected in the results.

All this effort assures you the nice, comfortable feeling that comes from knowing a trap will deliver on the job the full capacity claimed in the catalog.

* * *

There is one more ingredient that needs to be tossed into the trap-sizing pot. This morsel is the safety factor—the required excess of trap capacity over calculated condensate load. It will be the subject of the next advertisement in this series. But, in the meantime, if you'd like to get the lowdown, ask for a copy of the 44-page Armstrong Steam Trap Book. It is a complete guide to good trapping practice. It covers not only safety factors, but calculation of condensate loads and trap selection, installation, troubleshooting and maintenance. Just call your local Armstrong Factory Representative, or write: **Armstrong Machine Works, 8746 Maple St., Three Rivers, Michigan.**

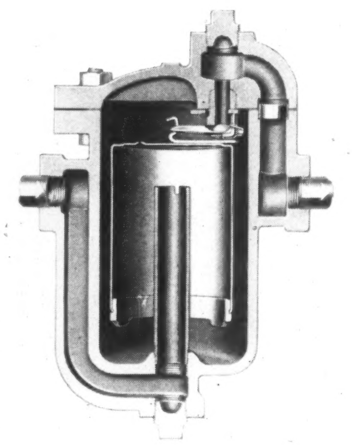


Fig. 2—Armstrong inverted bucket steam trap—hardened chrome steel valve and seat—stainless steel lever and bucket—simple, dependable, long-lived.

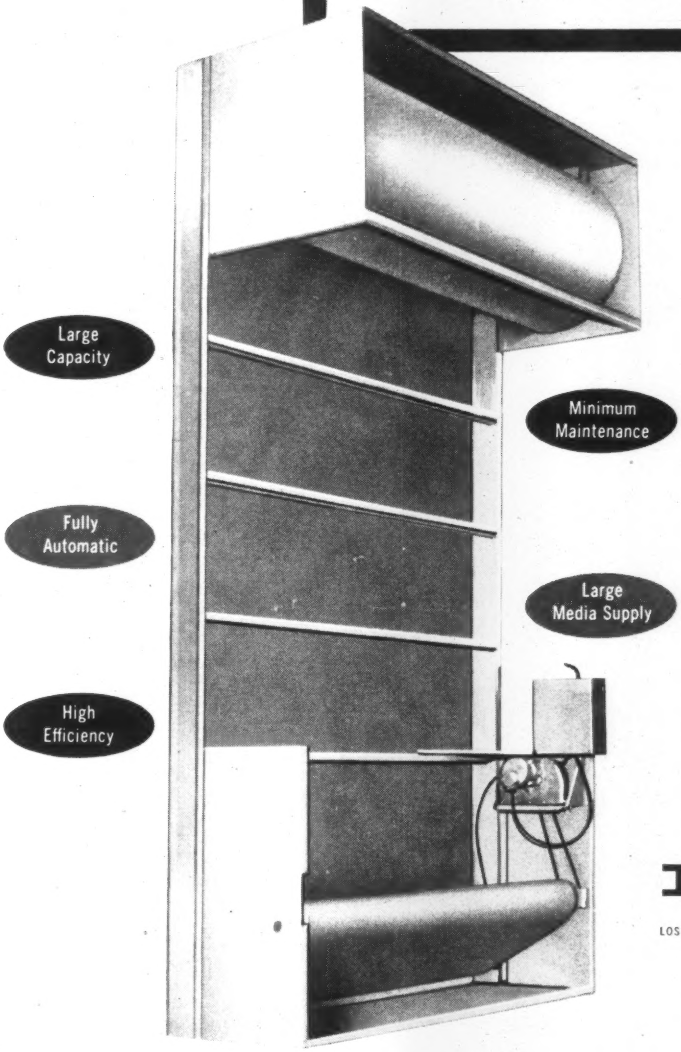
ARMSTRONG STEAM TRAPS

BRAND NEW!

FAR-AIR®

ROLL-KLEEN

automatic DRY FILTER



Here is a new, modern filter that combines fully automatic operation and high efficiency with large dirt holding capacity and minimum maintenance. Engineered for simplicity of operation, the Roll-Kleen offers dependable performance at low operating cost.

HOW IT WORKS

Glass fiber media with an open mesh cloth backing bonded to the downstream side, passes from the top supply roll, over the filtering area support grid, and onto the takeup roll. A preset rise in filter resistance, indicating dirty media, triggers the takeup roll drive to draw clean media completely over the support grid. This complete change-out assures maximum efficiency at all times.

PERFORMANCE

The Roll-Kleen is designed to operate at 350 to 520 fpm face velocity. Efficiency on Standardized Fine Air Cleaner Test Dust is 85% at 520 fpm and 80+% at 350 fpm.

MAINTENANCE

Other than occasional visual inspections, the Roll-Kleen is virtually maintenance-free. Warning lights (which may be located anywhere in your plant) tell when the media is dirt-loaded as well as when the media roll needs replacing.

CONSTRUCTION

Made of the finest quality components, the Roll-Kleen is available in standard widths of 3, 4 and 5 ft. and heights from 5 ft. to 15 ft. Units may be joined together to meet any CFM requirement.

Write for your copy of mechanical comparison bulletin F-105.

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Originators of **FAR-AIR** *Certified Filter Service*

Control leadership through advanced engineering—research

HONEYWELL ELECTRONIC CONTROL

Gives you flexibility in thermostat location, system functioning—and simplifies system adjustment

When it comes to performance, no other temperature control system can match the flexibility of Honeywell Electronics.

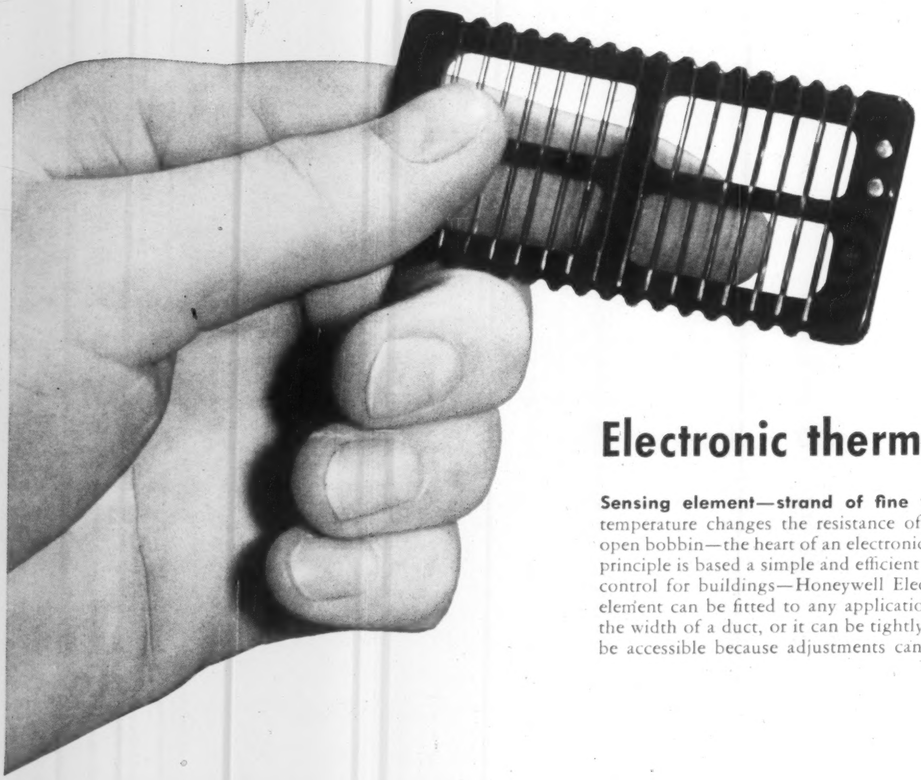
Because the control point and throttling range are unlimited, it is highly adaptable to any building control application.

And because it's *electronic* you can easily and inexpensively use additional thermostats for averaging—or for improved stability and accuracy. An example: the three-thermostat team, one in space, one in discharge air or water, one outdoors. And the faster response of electronic thermostats gives better performance for any client. Also, you can easily tie in electronic master control with pneumatic or electric controls.

When it comes to service, the wonderful simplicity of Honeywell electronic controls becomes readily apparent.

Thermostats, because they have no moving parts, give little trouble, need not be accessible. Checking and adjusting is all done remotely at a panel—electronically.

For complete information on Honeywell Electronic Controls, call your local Honeywell office. Or write direct to Minneapolis-Honeywell, Department HA-6-194, Minneapolis 8, Minnesota.

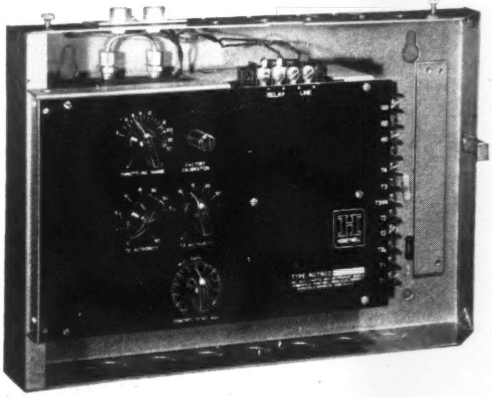


Electronic thermostat

Sensing element—strand of fine wire—A change in temperature changes the resistance of wire wound on an open bobbin—the heart of an electronic thermostat. On this principle is based a simple and efficient form of temperature control for buildings—Honeywell Electronic. The sensing element can be fitted to any application. It can be strung the width of a duct, or it can be tightly coiled. It need not be accessible because adjustments can be made remotely.

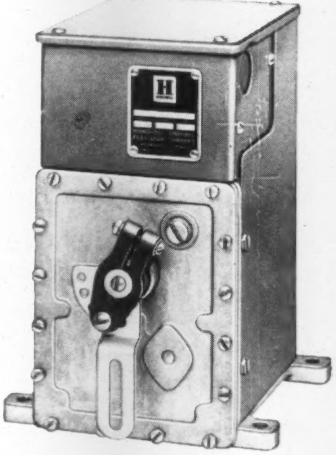
–SIMPLE WAY TO DO A BETTER JOB

Other system components



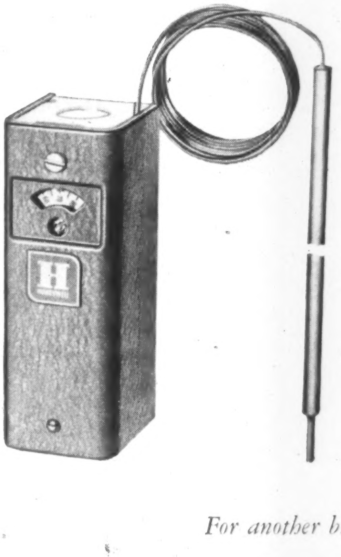
Electro-Pneumatic Relay—RO7902

This unit in conjunction with its electronic thermostats fulfills the function of pneumatic thermostats and puts out a control air pressure from an electronic sensing signal for use in a normal pneumatic control system. The RO7902 brings electronic convenience, accuracy and simplicity to your master-submaster jobs. It ties in the benefits of electronic sensing with your basic pneumatic system. When you replace your pneumatic thermostat with an electronic—and use it with the RO7902—all checking, adjustment and maintenance is done at the panel, eliminating all attention at the thermostat.



Electronic Motor—M7021

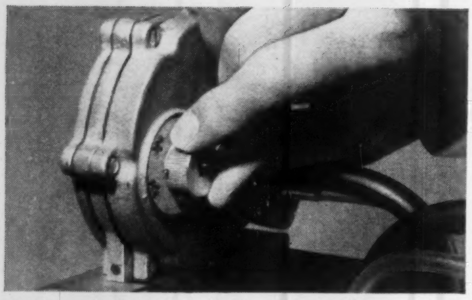
This damper or valve motor gives the advantages of an electronic control system without the necessity for a large control panel. Incorporated in the motor are the normal electronic amplifier and panel. It offers most of the advantages of a large control panel, yet is compact and simple. You have the finest, most stable type of control, you save wiring from panel to motor, save cost of mounting panel, save the space needed by a conventional panel. Installation is simple, economical. And the price is lower than if you were to buy a panel and motor separately.



Two-Position Control—L6018

The L6018 is one of a complete line of two-position controls and remote-bulb thermostat controllers for electronic or electric systems. These can be used for many switching functions—like automatic summer-winter changeover of large systems or even individual room conditioners. There are four models of the L6018—A, B, C, D. Each provides a different switching action for various control functions. Together they give an idea of the breadth of the Honeywell line. Controls in this series are low-cost, yet accurate. They are simply built to aid installation and service.

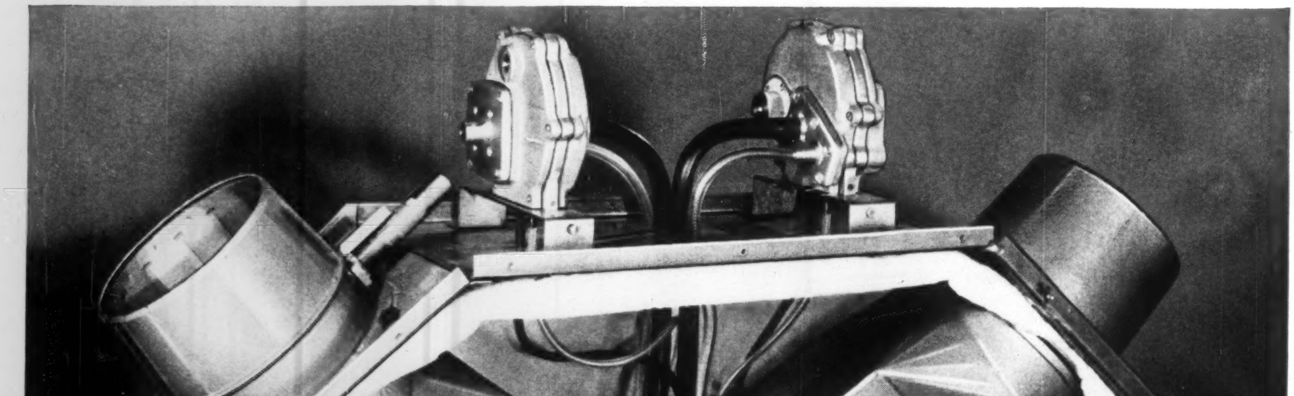
For another big, exciting Honeywell development in building control, turn the page →



Calibrated dial air balancing is the key to the superior performance of the Honeywell High Velocity Air Blender. You adjust dial only once, need never recalibrate again. Once balanced, comfort control is in the hands of the system thermostats.

Dial Air Balancing

NEW HONEYWELL HIGH VELOCITY



Fits any mixing box. The configuration you see here is but one of the many possible for ceiling units. Also, it's now available in nearly every under-the-window type unit. From the new Honeywell Blender you can expect controlled volume of air, constant CFM, long valve life and simplified control. The thermostat in the system controls temperature by controlling the volume of hot air passed by the hot duct. At the same time a flow regulator provides a constant hot air volume for a given thermostat signal under variations in supply duct pressures. A constant total flow is provided by a total flow regulator which operates the cold air valve to make up the difference between hot flow and desired total flow.

Control leadership through advanced engineering—research

AIR BLENDER SOLVES DUAL-DUCT DISTRIBUTION PROBLEMS

Provides constant delivered air volume, needs no recalibration when you add to system

WITH THE new Honeywell Air Blender your clients get the level of comfort they want—on the simple call of the room thermostat.

They get this easily, because the Honeywell Air Blender combines temperature and volume control in one unit.

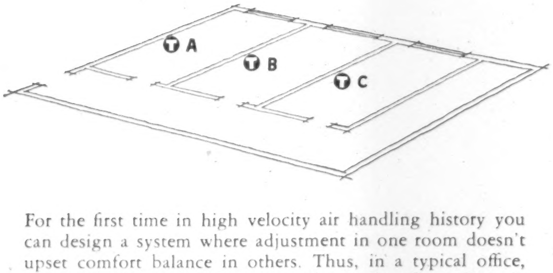
And comfort doesn't come at the expense of some other room. It comes from the system. *One room no longer "robs" another of comfort.*

Besides providing constant delivered air volume, the Honeywell Air Blender takes well to change. With Dial Air Balancing you can add to the system without having to recalibrate distribution points that may be scattered widely—especially valuable in floor by floor modernization or on new construction.

Self-powered, the Honeywell Air Blender uses the pressure of the air it is controlling to actuate the diaphragm—its only moving part. Such simplicity makes possible long life and trouble-free performance.

For further information about the Honeywell High Velocity Air Blender and other Honeywell heating and air conditioning products, call your local Honeywell office. Or write to Minneapolis-Honeywell, Dept. HA-6-194, Minneapolis 8, Minnesota.

No room "robs" comfort from another



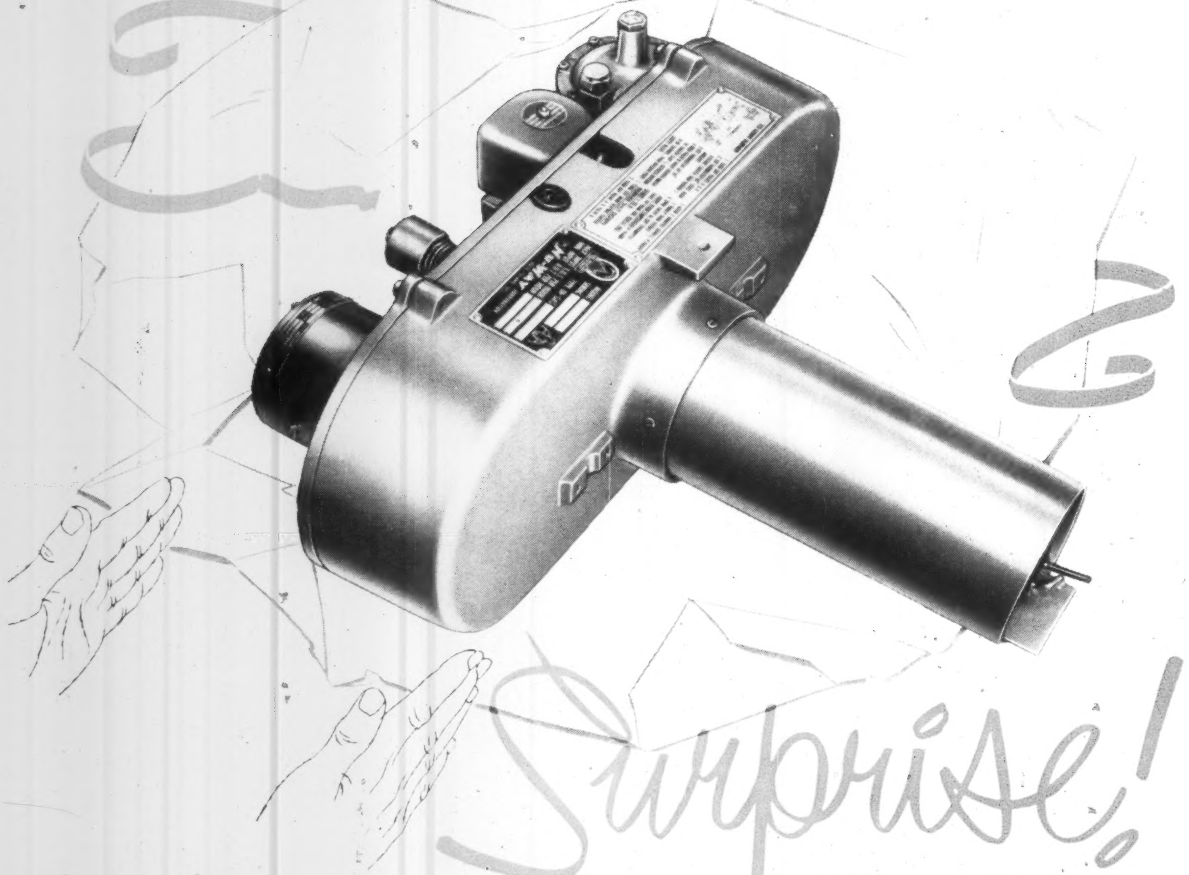
For the first time in high velocity air handling history you can design a system where adjustment in one room doesn't upset comfort balance in others. Thus, in a typical office, adjustment in area A does not rob comfort from B or C. Neither delivered air volume, nor the ratio of hot to cold air is affected in B or C. This is one of the reasons why it's wise to design with the new Honeywell Air Blender in mind.

The "new" look in thermostats that's appearing on walls of commercial buildings throughout America. New design *inside* gives closer control, vastly superior performance.

Only Honeywell gives you all four—pneumatic, electric, electronic, instruments.

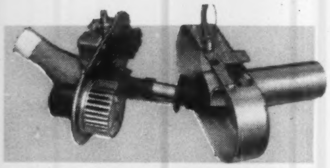
Honeywell

H HONEYWELL *First in Controls*

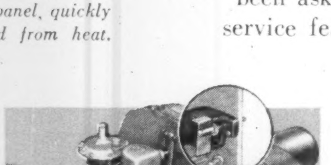


it's a Gas burner by Nu·Way

...and what slim-trim design


All operating parts and complete factory wiring on one panel, quickly removed . . . shielded from heat.

Just released after four years of exhaustive laboratory and field testing, this new power inshot gas burner is really a three-way surprise: First, here's a *gas* burner by this famous maker of *oil* burners. Second, its neat, compact design is just what the industry has been asking for. Third, its smooth operational and service features are as revolutionary as those found in Nu-Way oil burners. Quiet, too. Input rate 80,000 to 200,000 BTU per hour. Send immediately for "Model G-200 Manual," plus data on our sales-distribution policy. Write Nu-Way Corporation, Rock Island, Illinois.


Adjustable primary air gate. Quick on-the-job correction for differences in heating plant firing characteristics.

There is no one bolt that will meet all needs

. . . the same is true of air filters!

Bolts have *this* in common with air filters: there must be many different kinds to meet many different needs.

There is no one type of air filter that will meet all needs. That's why AAF (and *only* AAF) makes all types. Thus, you can be sure that *your needs*—not our salesmen—dictate AAF's recommendation of your air filtration equipment.

Before you select *your* filters, make sure you talk with the company that *offers* a selection. We'd like to show you how our complete-line approach to clean air needs benefits you—in *dollars* and *results.*

AAF American Air Filter
COMPANY, INC.
herman nelson
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

The one-and-only *Roll*-O-MATIC

AAF

Don't settle for a filter that just looks like the AAF *Roll*-O-MATIC ... Specify the original, and be sure of Roll-O-Matic's proven advantages!

No other product in the history of air filtration has ever received the immediate acceptance, gained the overwhelming preference of AAF's amazing Roll-O-Matic. Here are some of the reasons why it has emerged in just a few short years as America's most *successful* filter:

"MIRACLE" MEDIA. Exclusive Roll-O-Mat media offers the dust-holding capacity of a viscous filter, *yet handles like dry-type media.* And a 65 ft. length of this fluffy blanket of bonded glass fibers compresses to paper-like thinness . . . measures only 13" in diameter on the roll. Specially-developed AAF viscosine (for precharging media) retains its jelly-like consistency under an unusually wide range of temperature and humidity conditions.

AUTOMATIC PERFORMANCE. There are no dust disposal problems with Roll-O-Matic. They're rolled away as the automatically renewing media moves down the face of the filter. Maintenance involves simply replacing the soiled media roll with a new one, and most users have found that even this simple act is required only *once a year!*

LOW-COST OPERATION. Renewable Roll-O-Mat media is inexpensive, too. Under normal conditions, operating cost of the Roll-O-Matic is just *half* that of disposable filters. Call your local AAF representative for details, or write for Bulletin 248A.

CLEAN AIR BY THE ROLL! Man points to clean media being automatically introduced by the Roll-O-Matic in the Clark Equipment Company plant in Benton Harbor, Michigan. Architects and engineers: The Austin Company.

AIR FILTER!

SUPER-CLEAN AIR! Roll-O-Matic filters are used in combination with AAF's Electro-Cell precipitators to supply 158,000 cfm of super-clean ventilation air for the new Lutheran Brotherhood Building, Minneapolis, Minnesota. Architects: Perkins & Will; Engineer: E. R. Gritschke.

AAF Dust Control Equipment

Illinois Heating Specialties

— BETTER AIR IS OUR BUSINESS —

Herman Nelson Unit Heaters

Herman Nelson Unit Ventilators

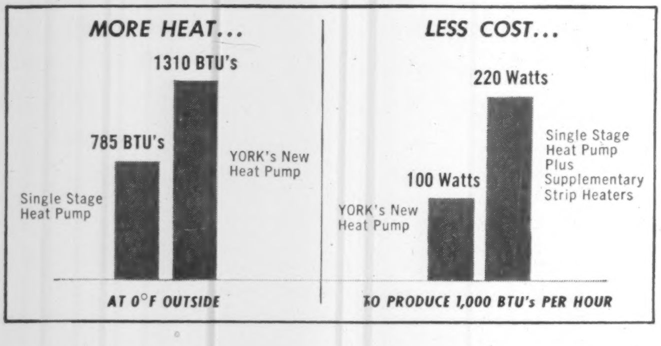
AAF herman nelson

American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

Even when it's zero, there's enough heat in the outside air . . .

Now! York heat pump takes warmth out of



MORE HEAT AT LESS COST! As shown in the chart at left YORK'S new air-to-air heat pump system* produces 67½% more heat at 0°F outdoor temperature than the former single-stage system of the same mechanical displacement. To supply the same heat output with the single-stage system would require supplementary strip heating and total wattage requirement would be 120% greater per 1000 BTU than YORK'S new compound compression system.

*Patent applied for.

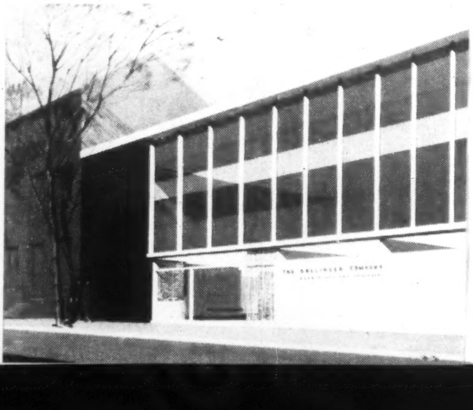
Heironimus

FIRST MAJOR INSTALLATION was at Heironimus department store in Roanoke, Va. served by the Appalachian Power Co. of The American Gas and Electric System.

Hayes, Seay, Mattern and Mattern, Architects and Engineers; B. F. Parrott and Co., Contractor.

NEW BUILDING for Ballinger Co. of Philadelphia features York heat pump, and is served by The Philadelphia Electric Co.

Ballinger, Architects and Engineers; J. S. McQuade, Jr., Contractor.



. . . to heat every room in your building!

sub-freezing air to heat an entire building

DRAMATIC ADVANCE MAKES HEAT PUMP PRACTICAL—WITHOUT SUPPLEMENTAL HEATING

The development by York engineers of the first practical heat pump to use below-freezing outside air promises convenient, more economical year-round air conditioning with a single system. No longer will supplementary strip heating equipment be needed in areas where winter temperatures drop below freezing.

The big difference in the York heat pump is that it takes advantage of a long-utilized refrigeration technique, compound compression. The system is operated by thermostatically controlled valves. These valves guide hot or cold water in and out of the system while compressors automatically move from single-stage compression into compound compression when the temperature drops below a certain point. Now that the high-operating-cost problem of auxiliary strip heating, needed where temperatures drop much below 32° F., has been eliminated, builders and owners can offer customers year-round air comfort at lower annual cost.

Electric Utilities faced with uneconomical air conditioning load factors will now be able to profitably promote the heat pump above the Mason-Dixon line. Until now the high operating cost of the air-source heat pump has limited application in Northern areas. But elimination of heat pump capacity deficiencies at low temperatures and removal of the very low load factors of strip heaters makes the new system attractive to both user and utility. For full details on the York heat pump write: York Corporation, subsidiary of Borg-Warner Corporation, York, Pennsylvania.

In Canada, Canadian Ice Machine Co., Toronto.

York
refrigeration
air conditioning

the quality name in air conditioning

YORK
B-W
BORG-WARNER

HEADQUARTERS
FOR MECHANICAL COOLING
SINCE 1885

YORK
CORPORATION
SUBSIDIARY OF BORG-WARNER CORPORATION

This wrap-around insulation goes on fast over any duct

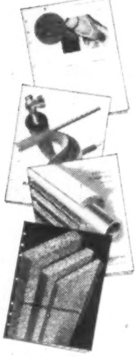
Highly efficient Armstrong Armaglas* Flexible Duct Insulation can be used on ducts of any size or shape operating up to 250° F. This glass fiber material is extremely light and resilient—is easy to apply to circular or rectangular ducts, even in limited working areas. Usual application is with Armstrong 536 Adhesive. Armaglas Flexible Duct Insulation is non-corrosive, stable, sanitary. It comes in plain rolls or with a wide selection of factory facings, including laminated kraft, aluminum foil, and aluminum pigmented vinyl.

Armaglas Flexible Duct Insulation is one of the many fine products in the complete line of Armstrong Industrial Insulations. Armstrong also offers you a full contracting service, geared to install these products economically and efficiently.

Armstrong INSULATIONS

for temperatures from −300° F. to +2800° F.

Free Booklets



Armstrong Armaglas Duct Insulations (data sheets)

Armstrong Armaflex®, a Flexible Pipe Insulation

Armstrong LT Cork Covering, a New Type Cold Line Insulation

Armstrong Corkboard for Low-Temperature Rooms

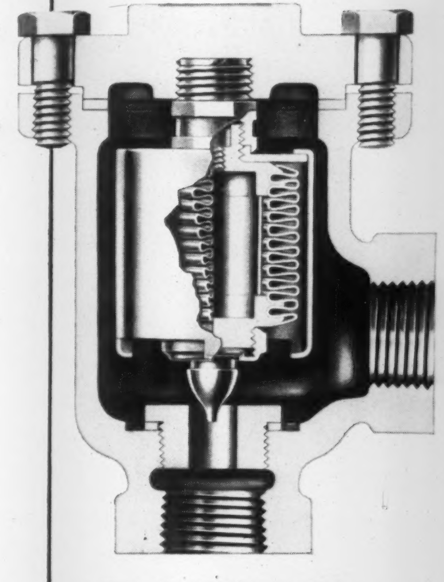
For full information write today to Armstrong Cork Company, 2306 Sherman St., Lancaster, Pa.

*® ARMSTRONG CORK COMPANY MANUFACTURED BY OCFCORP.

Proven by performance!

All departments agree on operating efficiency of SARCO Thermostatic Steam Trap

	MAINTENANCE	PURCHASING	STORES
1. **Same head and seat for 0-300 psi** — no changing of heads and seats for varying loads and pressures.	✓	✓	✓
2. **Fewer parts to stock** — same bellows, head and seat for 0-300 psi.		✓	✓
3. **Greatest capacity per dollar cost** — 1″ size discharges 9,650 lbs/hr at 10°F below steam temperature, 125 psi.		✓	
4. **Very compact and light** — ¾″ size fits in palm of the hand. Weighs only 3¾ lbs.	✓		
5. **Freeze-proof**—wide open, self-draining when cold.	✓		
6. **Only one working part** — the thermostatic element. Can be inspected or replaced in few minutes without moving trap from line.	✓		



SARCO

Balanced Pressure

THERMOSTATIC STEAM TRAP

Same seat and head for all pressures to 300 psi

•

Sizes ½″ to 2″

•

Write for Bulletin 250

Proven by testing!

Steam-tested — every single Sarco Thermostatic is steam-tested at rated maximum pressure.

Proven "on-the-job" performance — maximum fatigue-resistance for every thermostatic element is assured by Sarco's exclusive helical corrugating process and fatigue testing method.

Quality Control — every step of manufacture under exacting tests and controls . . . in Sarco's own plant.

Proven by experience!

During past 40 years, over 1,000,000 Sarco Thermostatics have been installed in countries throughout the world!

Sarco Company, Inc., Empire State Bldg., New York City

AN AFFILIATE OF SARCOTHERM CONTROLS, INC.

Only Sarco Makes All 5 Types

. . . that's why Sarco can give impartial advice on trap selection

Thermostatic Steam Traps

Liquid Expansion Steam Traps

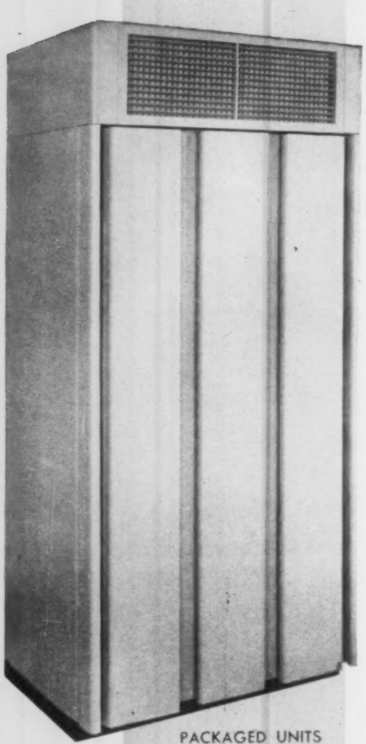
Thermodynamic Steam Traps

Float-Thermostatic Steam Traps

Camlift Bucket Steam Traps

2212-B

STEAM TRAPS • TEMPERATURE CONTROLLERS • STRAINERS • HEATING SPECIALTIES


PACKAGED UNITS
3 THRU 20 TONS

A Curtis FRANCHISE

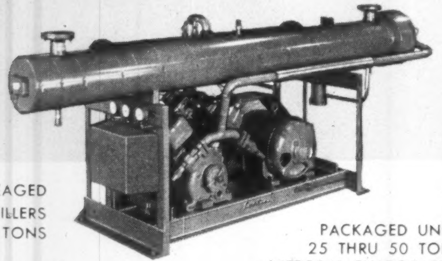
MAY BE THE ANSWER!

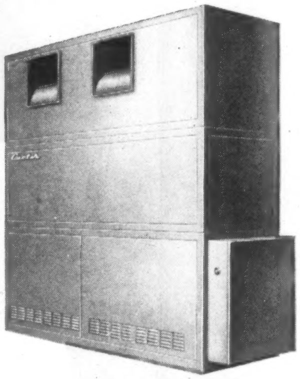
Curtis has been in business for 103 years and through experience has learned how to maintain a mutually profitable relationship with our franchise holders. Curtis equipment is competitively priced, quality built, and nationally advertised.

Write for details

PACKAGED AIR
COOLED UNITS
UP TO 7½ TONS

LOOK AT THE CURTIS LINE


PACKAGED
LIQUID CHILLERS
UP TO 100 TONS


PACKAGED UNITS
25 THRU 50 TONS
INTEGRAL EVAPORATIVE
CONDENSER OPTIONAL

YOU CAN COUNT ON

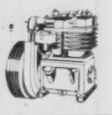
REMEMBER...

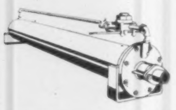
Curtis

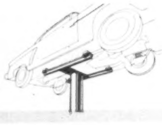
OUR 103rd YEAR

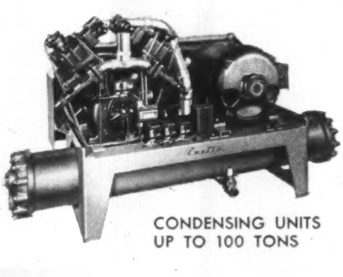
MANUFACTURING COMPANY
REFRIGERATION DIVISION
1950 Kienlen Ave. St. Louis 20, Mo.

CM-18


INDUSTRIAL
AIR COMPRESSOR


AIR HOISTS
AIR CYLINDERS

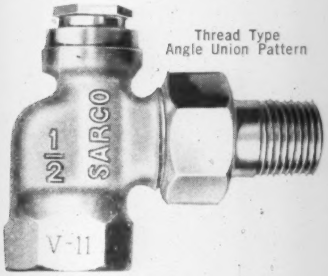

AUTO LIFTS

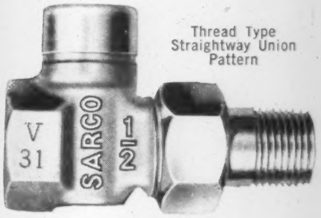

CONDENSING UNITS
UP TO 100 TONS

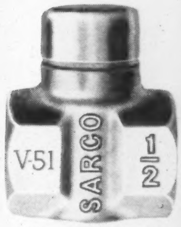
You don't have to treat 'em tenderly

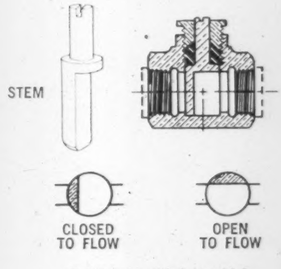
. . . these burly Sarco Balancing Fittings are extra-strong!

FOR USE UP TO 125 PSI
Every single one
TESTED AT 150 PSI!
Can be furnished with
INTEGRAL MANUAL AIR VENTS
All patterns also available in sweat-type.


Thread Type
Angle Union Pattern


Thread Type
Straightway Union
Pattern


Straightway Screwed Pattern



Solid segment stem which insures linear straight flow

Check other Sarco features that save installation headaches . . . assure top heating performance . . . save you money

Yes, these Sarco fittings are really husky . . . made of heavy brass, of highest commercial quality. They won't crack when you put a wrench on them . . . as lighter fittings often do. Won't cause delays . . . waste high-cost time. Will save you money in the end.

More accurate heat distribution is assured by the solid segment stem of Sarco Balancing Fittings (see cross-section diagram, right). Insures linear straight line flow, not obtainable with the usual butterfly stems.

Integral manual air vents can be furnished with Sarco Balancing Fittings. Their use avoids the headaches and costly time waste when a system has to be drained to release air.

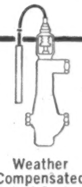
Sarco Balancing Fittings are made in thread and sweat types; all patterns. Also available . . . complete quality lines of access boxes for balancing fittings; valves; air eliminators. Ask for bulletins.

For undivided responsibility on your installations, specify and order from one "Complete Line" source . . . SARCO-SARCOTHERM. Sarcotherm Controls, Inc., Empire State Bldg., New York 1, N. Y.

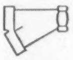
Sarcotherm

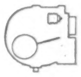
AN AFFILIATE OF SARCO CO., INC.

Products you can rest your reputation on


Weather Compensated Control Systems

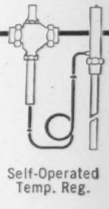
Radiator Valves • Traps


Strainers


Float-Thermostatic Traps

Water Blenders

Air Eliminators


Self-Operated Temp. Reg.

NEW!

Henry Abso-Dry®
Pressure Sealed Driers

U. S. Patent No. 2283989

HENRY
ABSO-DRY.
PRESSURE SEALED
DRIER
V612 - 3/8
HENRY VALVE CO.
350 psi, max. w.p.
PRESSURE SEALED DRIER
ABSO-DRY®
HENRY VALVE CO.
CONTROLLING FLOW
SINCE 1914
U. S. PATENT No. 2283989

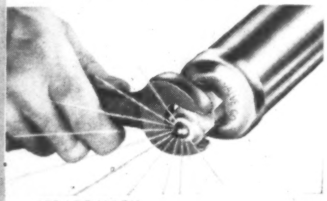
Only a HENRY DRIER proves its dryness with a Hiss©

To obtain maximum drying efficiency, Henry thoroughly reactivates each drier and, by an exclusive, patented process of manufacture, provides positive indication, by pressure sealing, that the drier is tight, dry, and factory-fresh on reaching the user.

Complete Size Range*—The complete range of types, capacities, and connection sizes permits the selection of the proper Henry drier for any installation.*

STOCKED AND SOLD BY LEADING JOBBERS.

*"They Hiss and Tell"**



***TRADE-MARK**
When the end connection seal of a new Henry drier is loosened prior to installation, there is a hissing sound due to the escape of dehydrated air.

HENRY VALVE CO.
MELROSE PARK, ILLINOIS (Chicago Suburb)
Cable: Hevalco, Melrose Park, Illinois

VALVES, DRIERS, STRAINERS, AND ACCESSORIES FOR REFRIGERATION, AIR CONDITIONING AND INDUSTRIAL APPLICATIONS

LISTED BY UNDERWRITERS' LABORATORIES, INC. UNDER RE-EXAMINATION SERVICE FOR WORKING PRESSURES OF 350 P.S.I. AND 500 P.S.I.

Owner:	House of Seagram, Inc.
Architects:	Mies van der Rohe & Philip Johnson
Associate Architects:	Kahn & Jacobs
Consulting Engineers:	Jaros Baum & Bolles
General Contractor:	George A. Fuller Company
Plumbing Contractor:	Eugene Duklauer Inc.
Mechanical Contractor:	Kerby Saunders Inc.

"In the new Seagram building it's 100% Walworth Gate, Globe, and Check Valves"

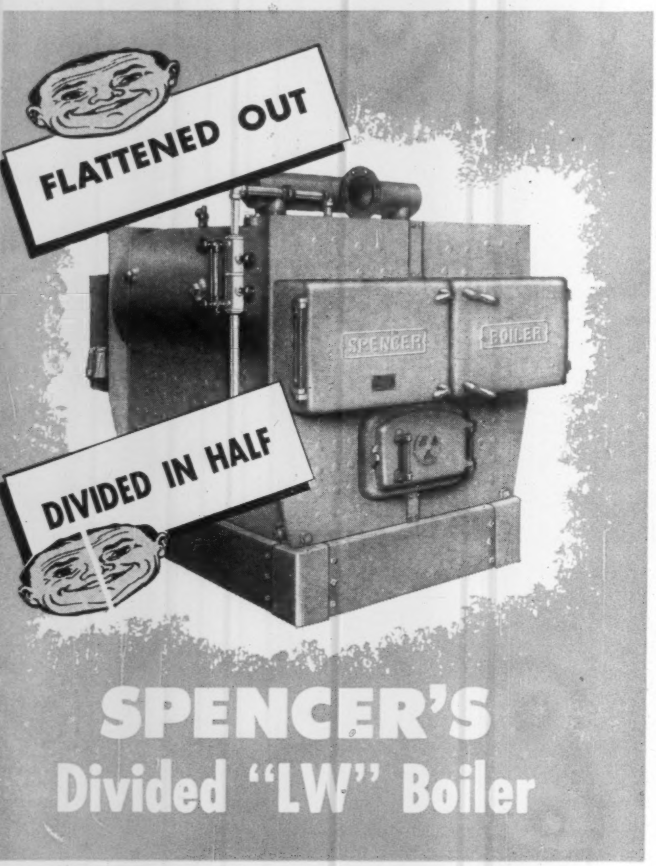
WALWORTH 60 East 42nd Street, New York 17, N. Y.

COMPLETE LINES OF STEEL, IRON, AND BRONZE VALVES AND PIPE FITTINGS

Distributors in principal centers throughout the world

Walworth Subsidiaries: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. M&H VALVE & FITTING CO. • SOUTHWEST FABRICATING AND WELDING CO., INC. • WALWORTH COMPANY OF CANADA, LTD.

SOLVE major heating problems with advanced SPENCER designs!



SPENCER'S
Divided "LW" Boiler

FAST HEATING
COMPACT DESIGN
SPENCER
SPENCER

SPENCER'S
"A" Boiler

Unique Low-Waterline "LW" solves installation problems

Divided in half . . . can be moved, one watertight section at a time, through narrow openings.

25% lower than conventional boilers of same capacity. Solves low headroom problems in existing buildings . . . excavation problems in new buildings. Traditional Spencer efficiency can be adapted to any fuel . . . mechanical or hand firing.

SIZES:
ranging from 2,200 to 42,500 sq. ft. steam

Durable Spencer "A" cuts installation time . . . provides economical heat

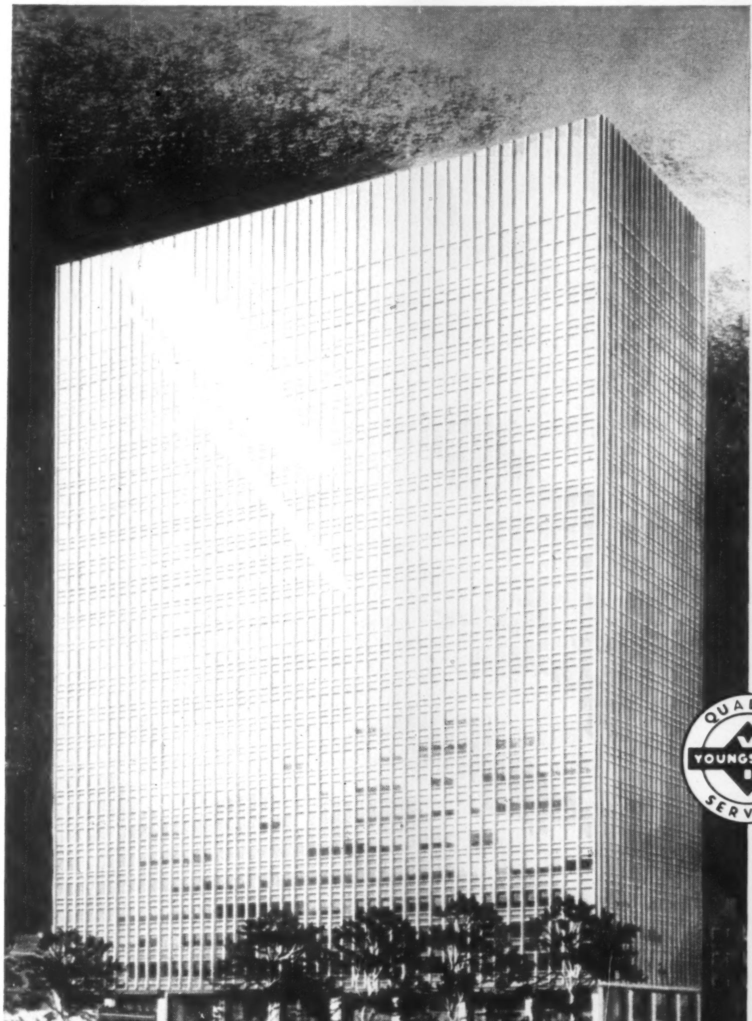
Unique flue- and smoke-boxes save hours in installation time; compact design saves valuable floor space—takes less headroom. Special peaked firebox and staggered boiler tubes provide faster heating . . . more efficient heat transfer; available for stoker or hand firing . . . can be adapted to any fuel.

SIZES:
ranging from 3,500 to 42,500 sq. ft. steam

SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA
SBI

Cleveland's "Modern as Tomorrow"
ILLUMINATING BUILDING
uses Youngstown Steel Pipe

Building Owner: 55 Public Square, Inc., New York, N. Y.
(A Vincent Astor-Brooks, Harvey & Company enterprise)
Rental and Managing Agents: Ostendorf-Morris Company, Cleveland, Ohio
Architect: Carson & Lundin, New York, N. Y.
General Contractor: George A. Fuller Company, New York, N. Y.
Structural & Mechanical Engineers: McGeorge Hargett & Associates
Consulting Mechanical Engineers: Jaros, Baum & Bolles
Heating & Air Conditioning Contractor: The Feldman Bros. Company, Cleveland, Ohio
Distributor: Grinnell Company, Cleveland



Cleveland's newest architectural beauty — this modernistic 22-story Illuminating Building — will provide much-needed air-conditioned office space for the "Best Location in the Nation". Owner of the new structure, 55 Public Square, Inc., and the architects, wisely chose Youngstown Steel Pipe to provide for a long-lived, dependable water supply system.

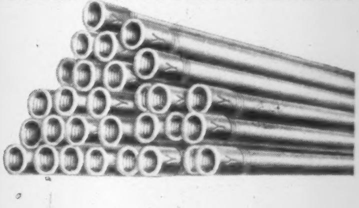
Youngstown Steel Pipe is the best pipe obtainable—anywhere. That's because it's made from our highest quality steel by men who have devoted their lives to the pipemaking business. Each and every step in Youngstown's completely integrated operations is closely quality-controlled by expert metallurgists to guarantee pipe that will meet your most exacting specifications.

Your nearby Youngstown Pipe Distributor has complete and ample stocks in all sizes. Why not call him today and discuss your requirements?

Specify Youngstown and secure these
7 Points of uniform goodness

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

QUALITY YOUNGSTOWN SERVICE



THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of
Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Wagner Type RA Single-phase Motor
Repulsion-start Induction 1 through 5 hp.

NOW...Wagner's high starting torque Integral hp single-phase motor is available in the latest NEMA frame sizes!

The well-known Wagner Type RA Motor is the workhorse of the single-phase motor field. This repulsion-start, induction-run motor combines the best features of the repulsion motor in starting, with those of the induction motor while running at rated operating speeds—ideal for applications requiring high starting torque.

No other single-phase motor has its ability to continually start heavy loads or perform with such complete satisfaction under continuous service.

Specifically designed for compressors, pumps, machine tools, grinders, and conveyors; it is preferred for many other single-phase high inertia or heavy friction starting applications because of its ability to start such loads with low current and with minimum light flicker.

Let a Wagner field engineer show you how these motors can be applied to your needs. Call the nearest of our branch offices, or write us.

OLD FRAME SIZE	NEW FRAME SIZE
203	182
204	184
224	213
225	215
254	254U

4 pole (1750 RPM, 60 cycle and 1450 RPM, 50 cycle) ratings are interchangeable in mounting dimensions with capacitor-start motors of the same ratings.

Wagner
Electric Corporation
SERVING INDUSTRY SINCE 1891

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

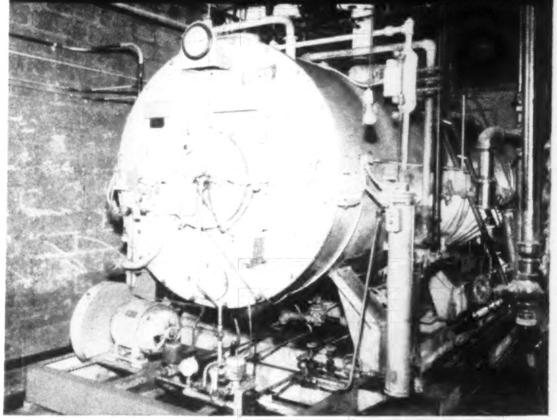
Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

M57-11

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

STEAM GENERATING PROBLEMS SOLVED

• • • a report by AMESTEAM GENERATOR

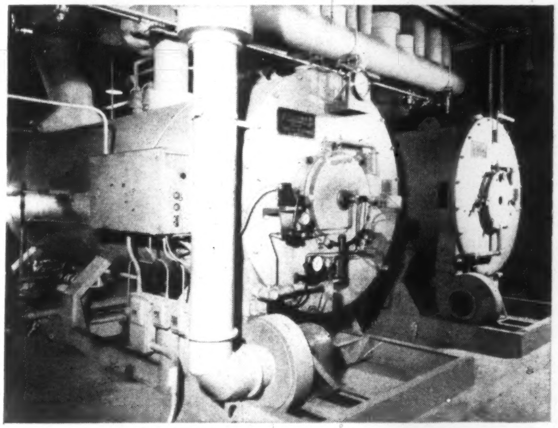


Dependable steam supply for a food processing plant by a compact, automatic Amesteam Generator.

LABOR SAVING ALONE PAID THE COST of the AMESTEAM GENERATOR installation in the plant of Victor Preserving Company. Writes Vice-President Donald E. Tobin:

"We have all the steam we need, when we need it, and, of course, the operation of the boiler is very much cleaner and simpler than our former boiler . . .

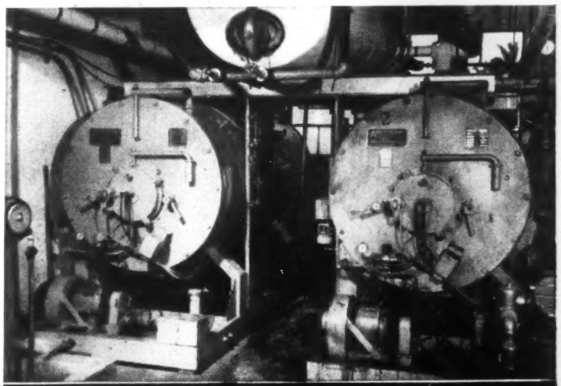
The saving in labor alone has more than justified the installation of the AMESTEAM GENERATOR to say nothing of the convenience and day after day dependability. The next time we need another new boiler, you can be sure it will be an AMESTEAM GENERATOR."



Supplying dependable heat for a large Junior-Senior High School — two efficient Amesteam Generators.

"CLEANER, VERY DEPENDABLE AND ECONOMICAL" writes Supervising Principal Charles Knapp about two AMESTEAM GENERATORS installed at Griffith Institute and Central School in 1955.

"We find them much cleaner, of course," reports Principal Knapp, "and we are also well pleased with their very dependable and economical performance. As you know, we still have coal fired boilers in the older buildings, so we have a chance to make a direct comparison."



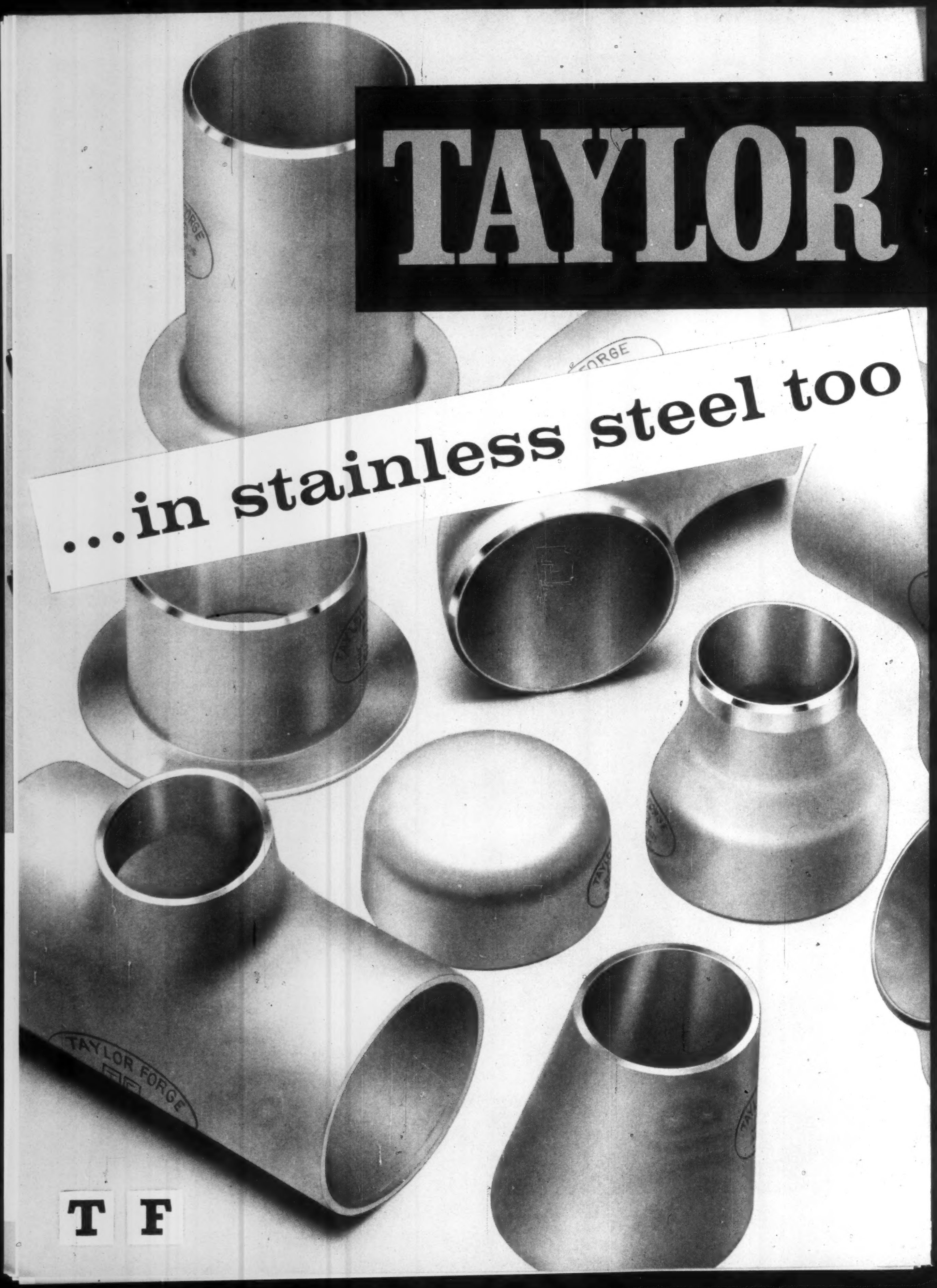
Variable steam requirements for a laundry ably met by these space-saving, easy-to-operate 60-HP Amesteam Generators.

"SIMPLE TO OPERATE . . . MINIMUM SERVICE . . . HIGHLY EFFICIENT", is the way Mark Denburg of Mark's Quality Cleaners & Launderers, Inc., describes his A-60 AMESTEAM GENERATORS.

"We can highly recommend AMESTEAM GENERATORS", writes Mr. Denburg, "to anyone considering the purchase of a steam generator. Our experience has been that they are simple to operate and require a minimum of service. They are highly efficient from a fuel standpoint and we are well pleased with them. You may feel at liberty to bring a prospective customer to see these units any time."

WHAT'S YOUR STEAM PROBLEM? If you need 10 to 600 HP and want the kind of space-saving, trouble-free service enjoyed by these owners of AMESTEAM GENERATORS, write today for our catalog and the name of your nearby AMESTEAM dealer.

AMES IRON WORKS INC.
BOX U-6 OSWEGO, N. Y.


TAYLOR
...in stainless steel too
TAYLOR FORGE
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FORGE Welding Fittings and Forged Flanges

The complete line . . . the quality line

. . . whatever you need . . . here it is . . .

- ✱ Schedules 5S—10S—40S—80S as well as all sizes and thicknesses covered by Standards in carbon steel.

- ✱ Seamless* WeldELLS—Tees—Reducers—Lap Joint Stub Ends—Caps—Crosses—Flanges—regularly furnished in stainless steel types 304—304L—347—316—316L. Details regarding other types of stainless and corrosion resistant alloys gladly supplied upon request.

*NOTE: Schedules 5S and 10S 90° and 45° WeldELLS are furnished seamless in sizes through 6″. Schedules 40S and 80S are furnished seamless in all sizes.

. . . TRADITIONALLY DEPENDABLE

Taylor Forge & Pipe Works

General Offices and Works: P. O. Box 485, Chicago 90, Illinois
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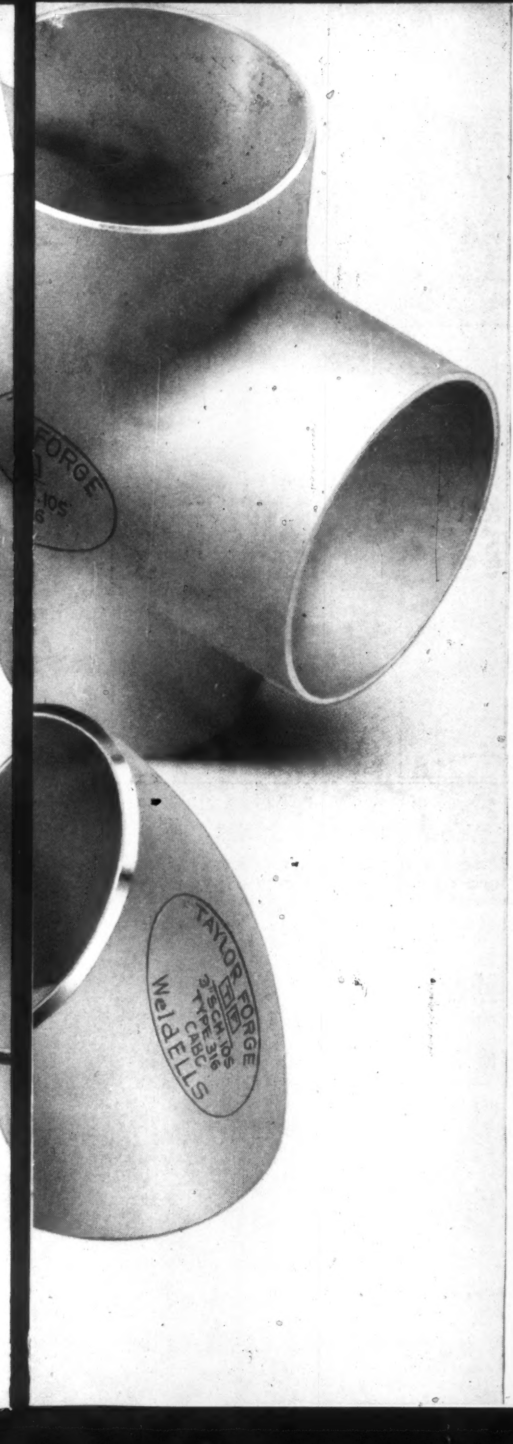
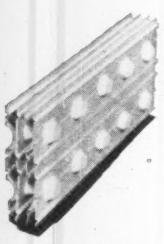
To take full advantage of both product excellence and fine service, patronize your local Taylor Forge Distributor.



6 GOOD REASONS WHY

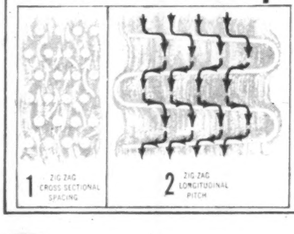
you should specify
the NEW Acme FLOW-MIZER®
COOLING TOWERS and EVAPORATIVE CONDENSERS

1 New Plastic Pak weighs 90% Less in FLOW-MIZER TOWERS!



The new all-plastic Acme-Pak makes Acme towers lighter, more economical than ever. In an average unit (100-ton), the entire pack now weighs only 180 lbs as against 2300 lbs for a comparable steel pack! This means real savings on installations and on freight. Better still, it can never rot nor rust . . . . is cleaned more quickly, less frequently. Total savings are two-fold: lower installed cost, lower maintenance cost.

2 Zig-Zag coil spacing means greater capacity, less HP in NEW FLOW-MIZER evaps


1 ZIG ZAG CROSS SECTIONAL SPACING
2 ZIG ZAG LONGITUDINAL PITCH

Acme's zig-zag spacing improves coil efficiency in two ways. (1) By staggering the tubes, air and spray water travel a longer zig-zag path, effecting greater turbulence and better heat transfer. (2) By sloping the tubes longitudinally, spray water remains in longer contact with each tube. Also, the condensed refrigerant drains more rapidly. The result is more efficient evaporation . . . which means more capacity in less space with less blower hp.

3 Twice as much surface protection

Acme's hot-dip galvanizing *after* fabrication deposits twice the thickness of zinc that ordinary electroplating does. This double protection against rust leaves no surface exposed. Units never need painting.

4 Easily serviced external sump

On both cooling towers and evaps, Acme's external sump provides quick easy access. Sediment screen, float valve, and water treatment facilities are reached by lifting the cover.

5 Full access to coil or pak

For fast, easy maintenance, the new Acme units offer convenient access to nozzles, eliminators, pack or coil by removal of full-width panels front and rear. Sliding doors provided for quick inspection.

6 Balance where it counts

After final assembly, All Acme blower units are now electronically balanced to assure quiet, smooth operation at all times . . . less wear on blower bearings . . . greater efficiency . . . longer trouble-free service.

New Acme Catalogs, Nos. 311 and 361 give full details. Write for them today.

ACME AIR CONDITIONING REFRIGERATION

Acme INDUSTRIES INC. Jackson, Michigan

Dry-Ex Liquid Chillers

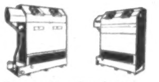
Liquid Receivers

Heat Exchangers

Condensers

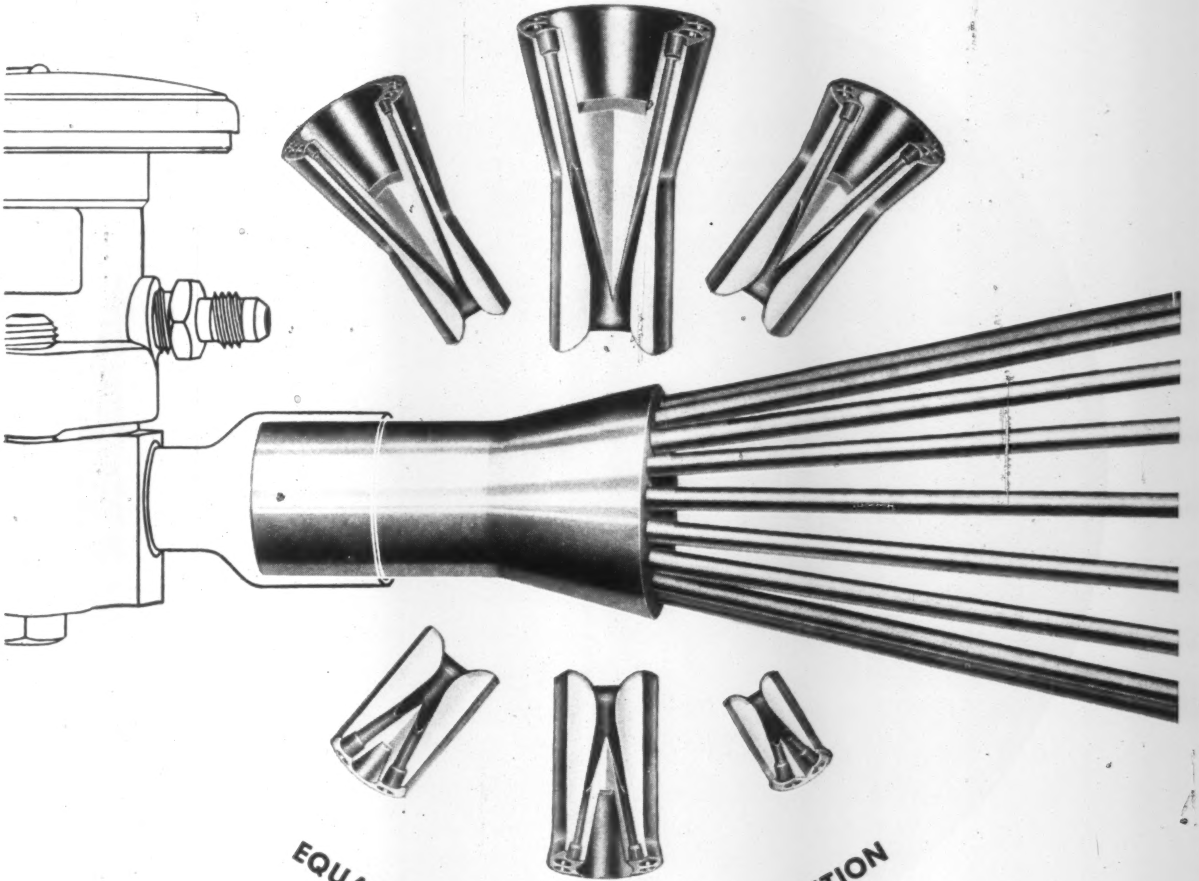
Packaged Chillers

Packaged Heat Pumps


Evaporative Condenser & Cooling Towers

Room Conditioners

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919



EQUAL DISTRIBUTION IN ANY POSITION

one-piece ALCO venturi-flo distributor

Low pressure drop—Permits closer, more economical thermo valve sizing.

Wide application range—from 25% of capacity to 150% of rated capacity.

One-piece—No nozzles or orifice plates to stock and install.

One Venturi-Flo replaces distributors requiring as many as 6 or 7 nozzles!

Easy to select—No nozzles to size.

BUY QUALITY—BUY ALCO WRITE FOR BULLETIN 188-55

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ALCO

ALCO VALVE CO.

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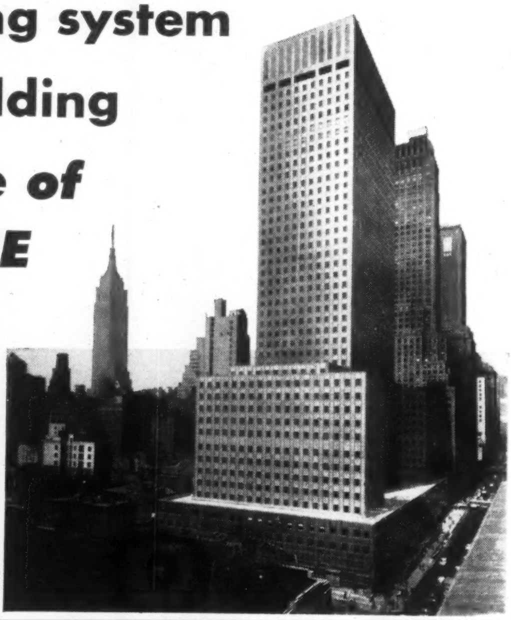
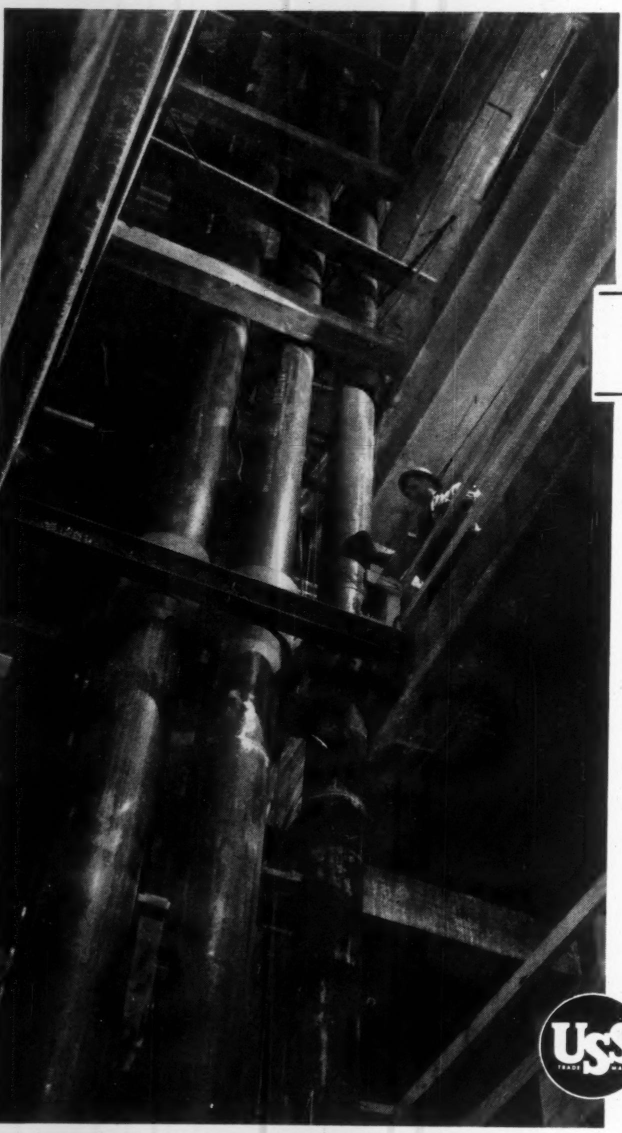
Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

7043

Ingenious air-conditioning system of Socony-Mobil Building *makes liberal use of* ***NATIONAL PIPE***



Owner: Galbreath Corp., John W. Galbreath and Peter B. Ruffin
Architects: Harrison & Abramovitz
Associated Architect: John B. Peterkin
General Contractor: Turner Construction Company
Mechanical Engineers: Jaros, Baum & Bolles



This gleaming, 45-story, stainless-steel-sheathed building is the largest air-conditioned office building structure ever erected. Its remarkable air-conditioning system is powered by purchased steam, which is actually used twice. In the basement there is a refrigeration plant, consisting of 3 centrifugal steam turbine driven compressors of 2600-ton capacity. These 3 units are driven by steam turbines operating full condensing, with the exception of one which is a partial condensing and exhaust. This exhaust steam, by means of a 10-inch steam main, is tied in with the building's steam distribution system. This 10-inch main serves, during summer operation, all the steam requirements for the tempering coils in the air-conditioning system, as well as the steam required for three 500 Lithium Bromide Absorption Machines. In other words, the three 500-ton units act as a surface condenser for the exhaust steam—the building enjoying the economics of this ingenious piping layout.

Approximately 470 tons of USS National Pipe—most of it Seamless—were used in the construction of the air-conditioning and heating systems. And at least 350 tons of National Seamless were used in the huge building's plumbing system.

As is so often the case in designing complex plumbing and heating systems, the engineers selected National Pipe. They knew from past experience that, no matter how rigorous the conditions, National would do the job, and do it well.

If you'd like more information on the use of National Pipe in plumbing and heating, air-conditioning and power installations—large or small, simple or complex—get in touch with us. Our experienced engineering staff is at your service.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL PIPE

UNITED STATES STEEL

The mark of one source
one responsibility
for all your air
conditioning control
requirements

Choose the only complete line! Coordinated, matched control systems *from one manufacturer* are your safest bet when you pencil in your next design specifications. Only from General Controls can you select the entire control package right across the board.

Forty factory branch offices in U.S.A. and Canada will back your buying decision each work day in their daily contact with your field organization. Regular service and educational meetings build confidence in your control components, keep your products sold.

WRITE FOR THE COMPLETE CATALOG AVAILABLE ON THESE CONTROLS—

THERMOSTATS
T-230/240 Series Heating-Cooling Thermostat—one of several deluxe and standard models for automatic or manual switch-over, one or two-stage cooling, fan operation, cooling models. Humidity controls also available.

MASTER CONTROL PANELS
RS-108 Panel—furnishes prewired simplicity of complete electrical center for heating and cooling connections. Available in sufficient variations to fit every application.

SOLENOIDS
Solenoids . . . for all refrigerants, pressures and pipe sizes. General Controls is the largest solenoid manufacturer in the world!

RELAYS, MOTOR STARTERS, CONTACTORS
RS-105—Motor Starter—for commercial systems where control panels won't do the job. Also available—relays and contactors for fan and circulator control.

EXPANSION VALVES
V-200 Series—models available for all tonnages; superheat variations, and selective connectors with adjustable orifices to reduce inventory.

Five Plants:
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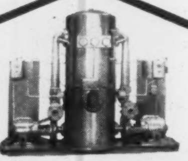
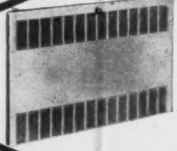
[illegible]'s Finest Automatic Controls for Home, Industry, and the Military

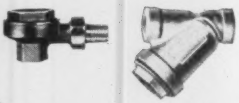
Factory Branch Offices Serving *All* Principal Cities of the United States and Canada

All Pumps, Convectors and Steam Specialties by DUNHAM-BUSH

ON THIS NATKIN & COMPANY HEATING JOB







CARDINAL GLENNON MEMORIAL HOSPITAL FOR CHILDREN

NATKIN & COMPANY
St. Louis, Missouri
Heating Contractor

MAGUOLO & QUICK
St. Louis, Missouri
Architect

HARRY F. WILSON
St. Louis, Missouri
Consulting Engineer

PUMPS
by Dunham-Bush
- VRD65 Duplex Vacuum Pump
- VRDA15 Duplex Vacuum Pump
- CH2030 Duplex Condensation Pump
- CH3030 Duplex Condensation Pump
- CH5030 Duplex Condensation Pump

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STEAM SPECIALTIES
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Plus Multi-Speed UNIT HEATERS
by Dunham-Bush.

Every day . . . Dunham-Bush "one source—one responsibility" . . . makes more sense to more people who specify and install heating equipment.

At the Cardinal Glennon Memorial Hospital for Children in St. Louis, for example, you'll find *all* pumps, *all* specialties, *all* convectors are by Dunham-Bush.

Let Dunham-Bush assist you in your heating plans. Write for details of our complete heating line.

America Looks to DUNHAM-BUSH *for Modern Heating*

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WEST HARTFORD 10, CONNECTICUT, U. S. A.
SALES OFFICES LOCATED IN PRINCIPAL CITIES

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TRADE MARKS

Think you'll ever need A-power fittings like these?

TUBE-TURN* Stainless Steel Elbows—heavy wall thickness for nuclear energy reactor.

Name your piping problem...
TUBE TURNS CAN HELP YOU!

No matter what kind of welded piping system you build . . . here's how Tube Turns can be of help:

Tube Turns' line includes 12,000 *standard* welding fittings and flanges, plus thousands of *specials* such as the A-power fittings shown above. When you buy from this *complete-line* leader, you get what you need *promptly* . . . products of unsurpassed *quality* . . . backed by experienced *engineering service* . . . for reliable, *low-cost piping*. Order from your nearby Tube Turns' Distributor.

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

The Leading Manufacturer of Welding Fittings and Flanges

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A Division of National Cylinder Gas Company

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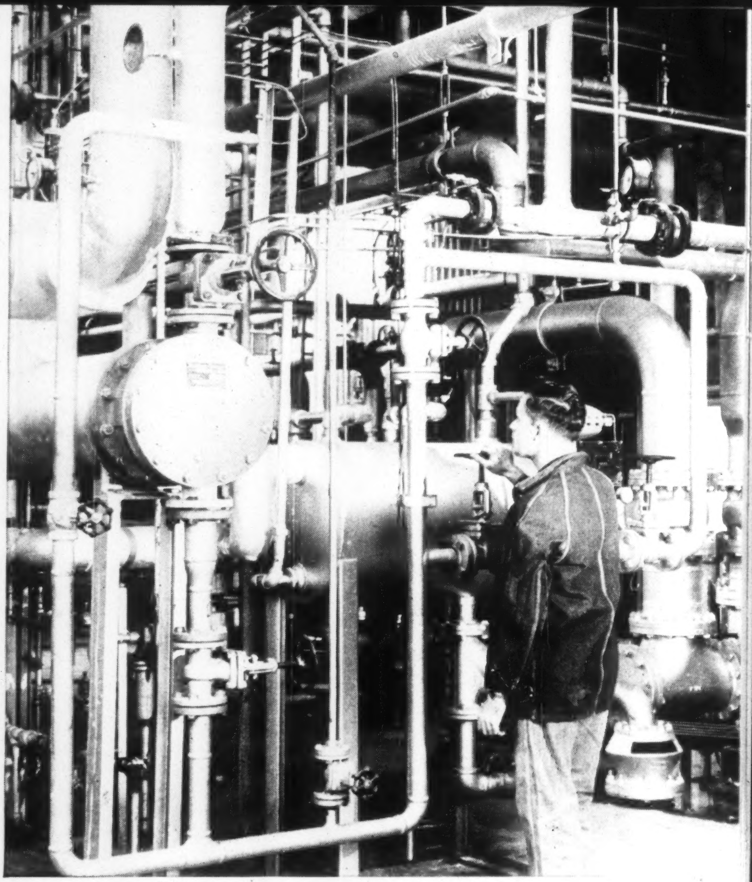
HOW YOU SAVE

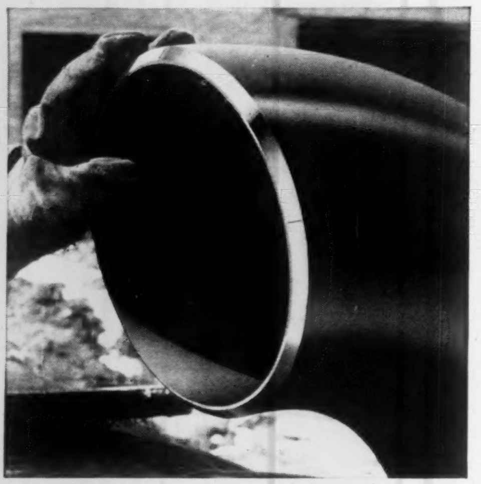
12,000

"TUBE-TURN" PRODUCTS

to help you save 3 ways . . .

SIMPLIFIES ENGINEERING. There's no compromise when you specify TUBE-TURN products. You can count on getting the exact fittings for your project . . . the right type, size, schedule and material for every piping service. Shown at right: Aluminum piping with TUBE-TURN Welding Fittings and Flanges, in water purification plant of The General Tire & Rubber Company, Chemical Division, Ashtabula, Ohio.





SPEEDS UP THE JOB. Uniform size, circularity, wall thickness of TUBE-TURN Welding Fittings assure good fit-up and alignment . . . help make piping installation work faster. Each fitting is marked with *complete* specifications for quick, accurate identification. Quartermarked bevels simplify fabrication.

ONE-ORDER PURCHASING. Your nearby Tube Turns' Distributor provides this complete-line service promptly. Hence, you can make *one order* fill all your needs in welding fittings and flanges . . . to cut red tape and save purchasing time.

HELPFUL DATA. New Tube Turns' booklet gives information on pipe, fitting and flange materials. Mail coupon for your free copy.

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Please send free copy of Pipe, Fitting and Flange Materials.

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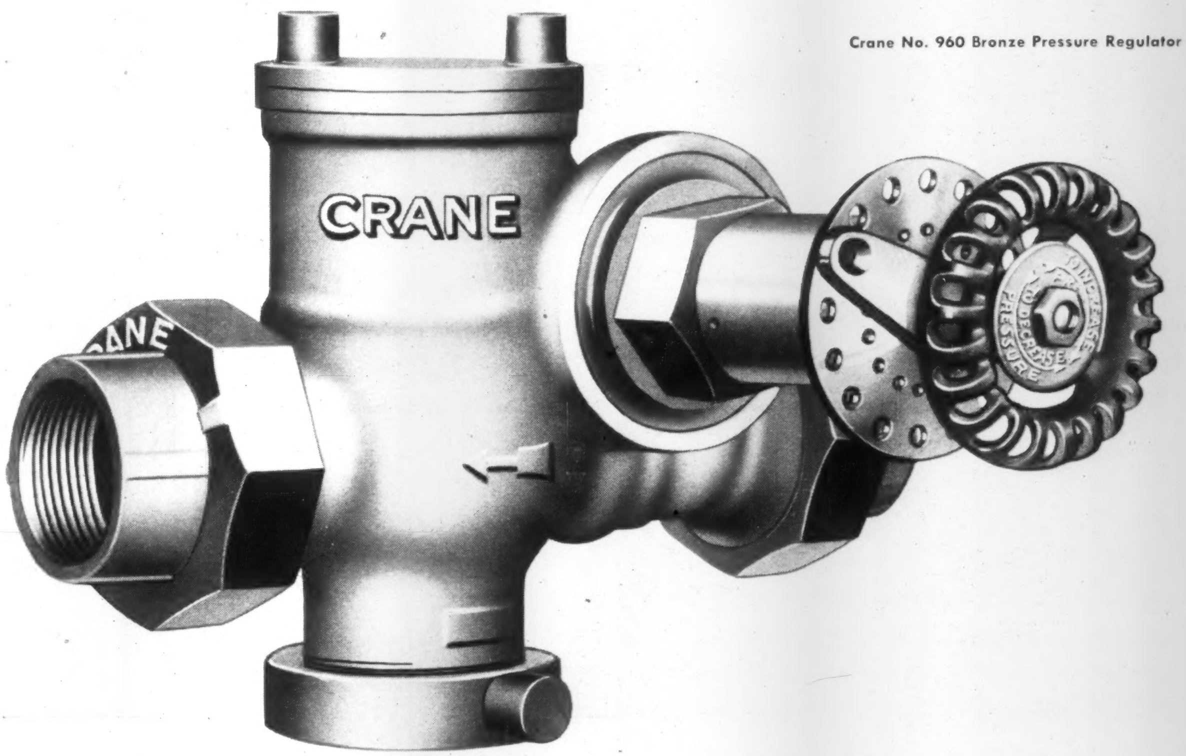

CRANE
CRANE
INCREASE
TO DECREASE
PRESSURE

Crane No. 960 Bronze Pressure Regulator

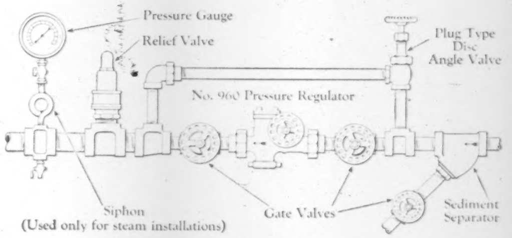
for dependable, *precision* control of steam and air pressure

CRANE PRESSURE REGULATORS

For accurate regulation of steam and air pressure, you're safe and sure when you specify Crane No. 960 Bronze Pressure Regulators.

Because they are Crane-designed and Crane-built for long, trouble-free operating life, these rugged, precision type regulators meet the most exacting requirements of modern heating systems, air blasts, cookers, driers, vulcanizers and other process equipment.

With Crane Bronze Pressure Regulators, outlet pressure cannot build up to inlet pressure when there is no steam or air demand on the outlet side. Equally important, ordinary fluctuations of inlet pressure do not affect the outlet pressure.


Pressure Gauge
Relief Valve
Plug Type Disc Angle Valve
No. 960 Pressure Regulator
Siphon (Used only for steam installations)
Gate Valves
Sediment Separator

HOW TO HOOK UP YOUR CRANE PRESSURE REGULATORS

NEW LITERATURE ON REQUEST

Available in sizes ½ to 2 inches; maximum inlet pressures 250 pounds air or 250 pounds steam up to 450° F.

New circular helps you select proper regulator for your needs. Ask your Crane Representative for a copy, or write to address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

THEY CHANGE THEIR OWN FILTERS–AUTOMATICALLY!

HERMAN NELSON

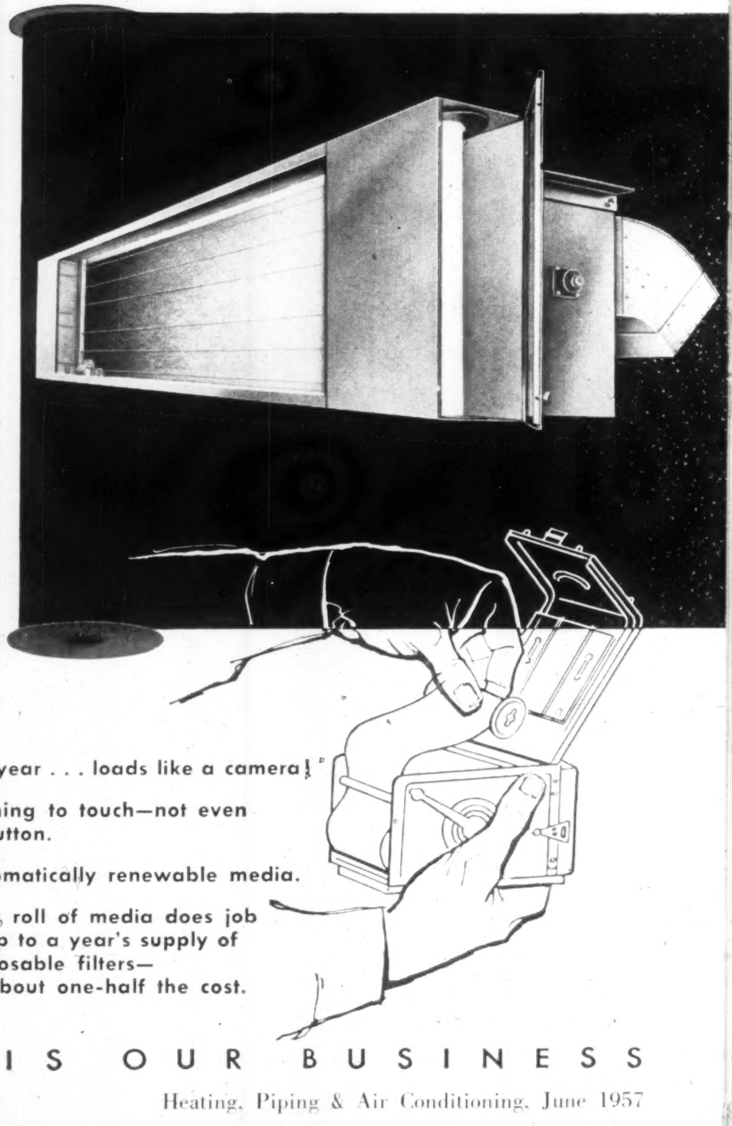
ROLL O VENT

AIR HANDLING UNITS

NEW, COMPLETELY AUTOMATIC IN OPERATION, the exclusive AAF Roll-O-Matic Air Filter Principle is now available on three leading Herman Nelson ROLL-O-VENT air handling units. You simply put the roll of media in the unit—*and forget it*—for up to a year! Operation is completely automatic, and under normal conditions costs just half that of ordinary disposable filters.

You gain maximum filtering efficiency *all year round*—with little or no maintenance. There is no reduction of efficiency in the system due to clogged filters. Furthermore, the system is always in balance—air flow *constant*—because clean media is automatically changed at just the right time!

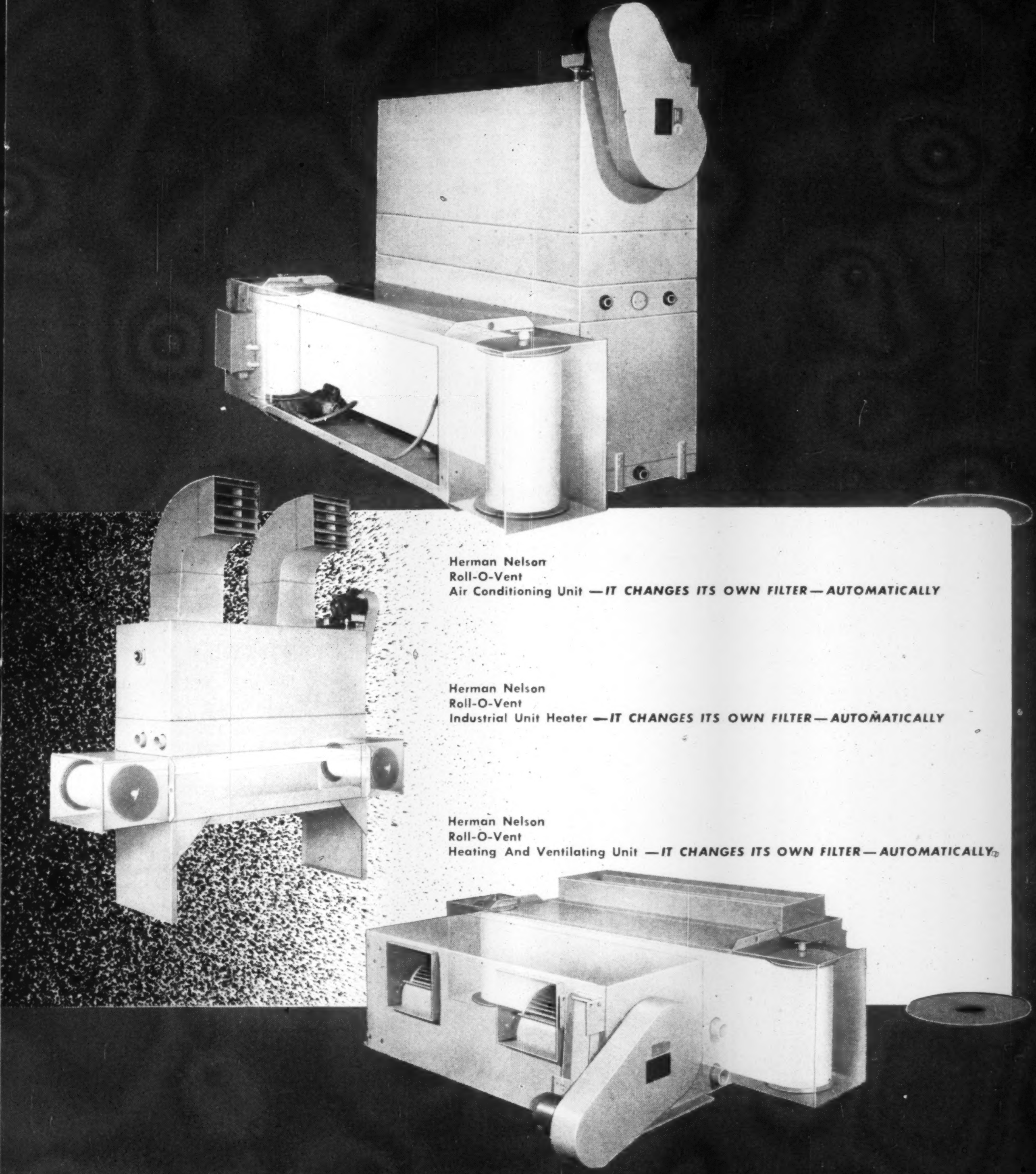
Take advantage of the important time and cost-saving features provided by this exclusive AAF development. Write for full details on "packaged" Herman Nelson ROLL-O-VENT heating, ventilating and cooling units. Ask for fact-filled Bulletin 780. Address Dept. 373.



One roll of media lasts up to a year . . . loads like a camera!

- **Nothing to touch—not even a button.**
- **Automatically renewable media.**
- **Each roll of media does job of up to a year's supply of disposable filters—at about one-half the cost.**

BETTER AIR IS OUR BUSINESS



Herman Nelson
Roll-O-Vent
Air Conditioning Unit —*IT CHANGES ITS OWN FILTER—AUTOMATICALLY*

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Heating And Ventilating Unit —*IT CHANGES ITS OWN FILTER—AUTOMATICALLY*®

AAF®

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American Air Filter

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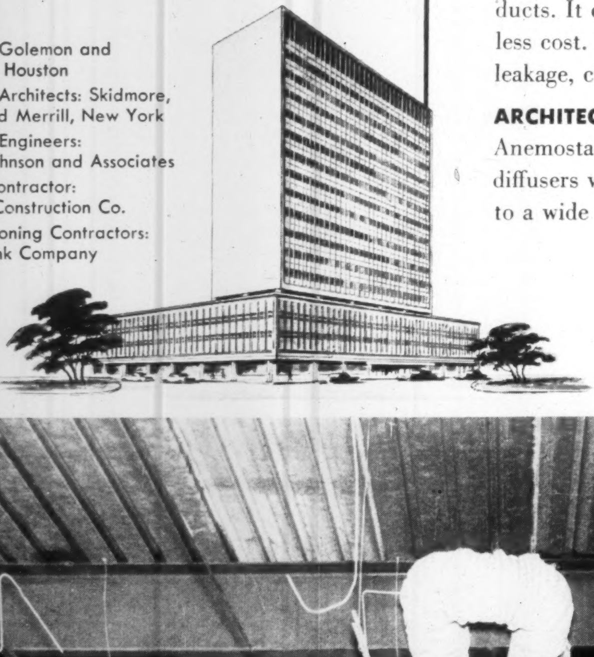
215 Central Avenue • Louisville 8, Kentucky

How *high velocity* solves problem of *flexibility* in the Medical Towers

Architects: Golemon and Rolfe, AIA, Houston
Consulting Architects: Skidmore, Owings and Merrill, New York
Consulting Engineers: Bernard Johnson and Associates
General Contractor: Tellepsen Construction Co.
Air Conditioning Contractors: Straus-Frank Company



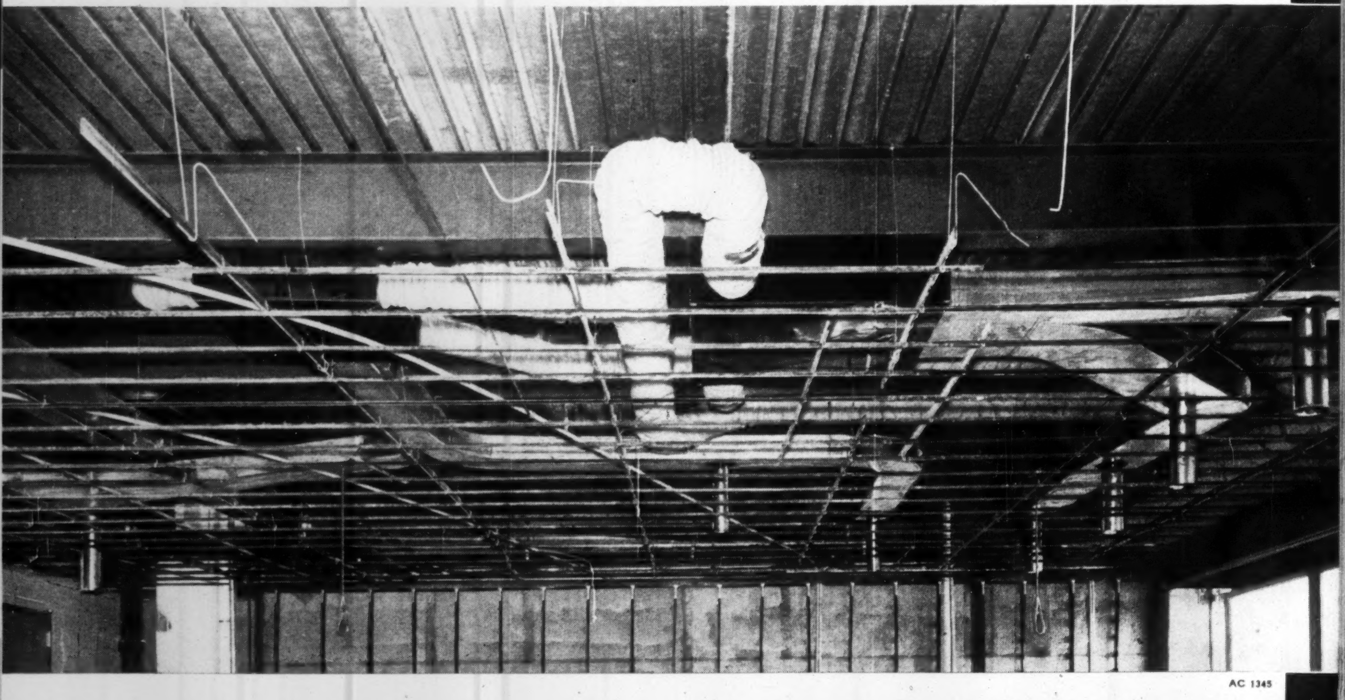
When the new Medical Towers Building in Houston, Texas was planned, the key air conditioning problem was flexibility. Professional office areas had to be subdivided *after* the building was completed. Here's how an Anemostat dual duct high velocity air distribution system solved the problem.

As shown in the diagrammatic sketch, a system of perimeter take-offs from the hot and cold ducts enables each doctor to provide the exact temperature he wants. Temperatures in the various rooms of each suite of offices can be varied. Air distribution is draftless, comfortable, perfectly suited to tenants' needs.

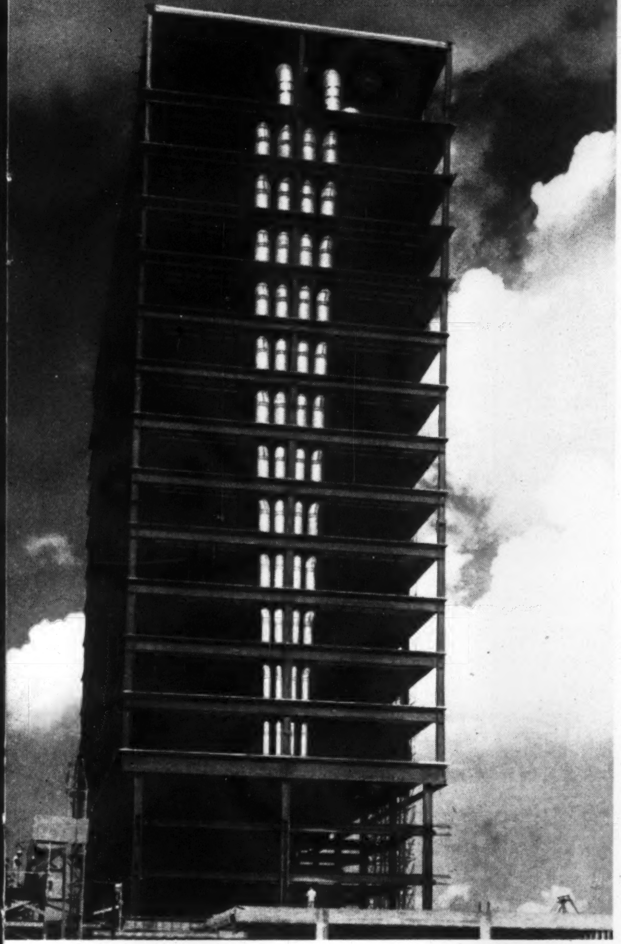
The Anemostat All-Air High Velocity distribution system offers further important advantages. It can be used with smaller than conventional ducts. It can be installed in less time and at less cost. It requires no coils, thus eliminates leakage, clogging and odors.

ARCHITECTS—Attention Please:
Anemostat round, square and straightline diffusers with high velocity units are adaptable to a wide variety of architectural designs.

Anemostat HPE units and duct connections installed in office before construction of ceiling and walls



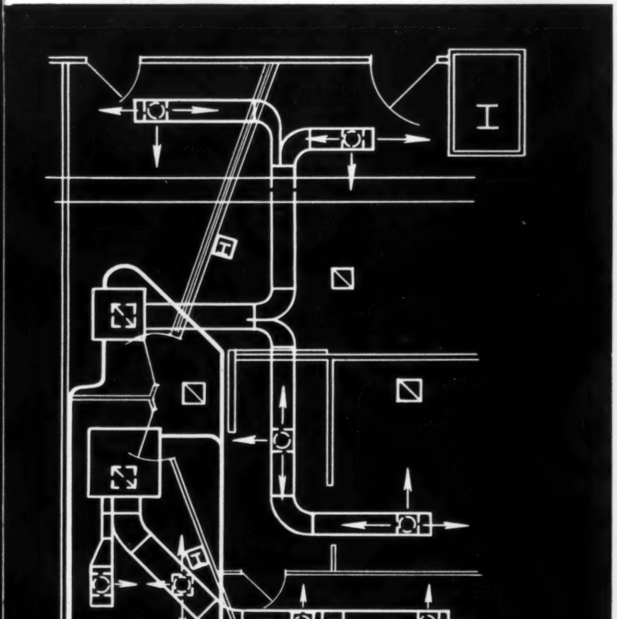
AC 1345



Note how locating of hot and cold ducts saves space in new Medical Towers Building, Houston, Texas

View of lobby showing Anemostat Air Diffusers

View of professional reception room



Layout of typical suite

SELECTION MANUAL NO. 60—1957
ANEMOSTAT
Air Diffusers

Write on your business letterhead for your copy of

New Anemostat Selection Manual 60

to Anemostat Corporation of America, 10 East 39 Street, New York 16, N. Y.

ANEMOSTAT: The pioneer of All-Air High Velocity Systems

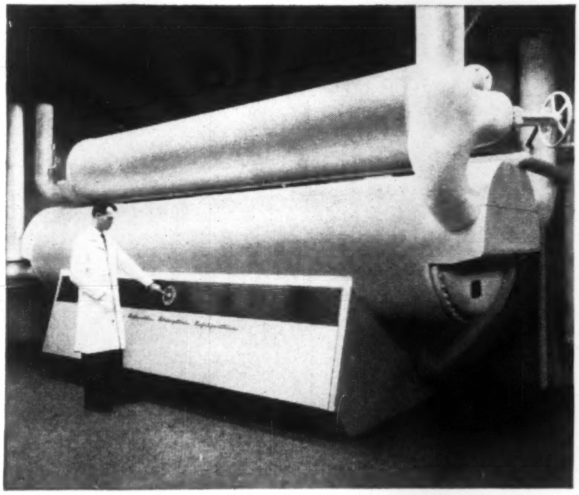
Which is the best way to air condition a factory?

It depends on your factory. Its size, its shape and its manufacturing processes are all important. The available power facilities, too, are important in determining which refrigerating machine is best. Carrier sells many types of air conditioning and refrigeration.

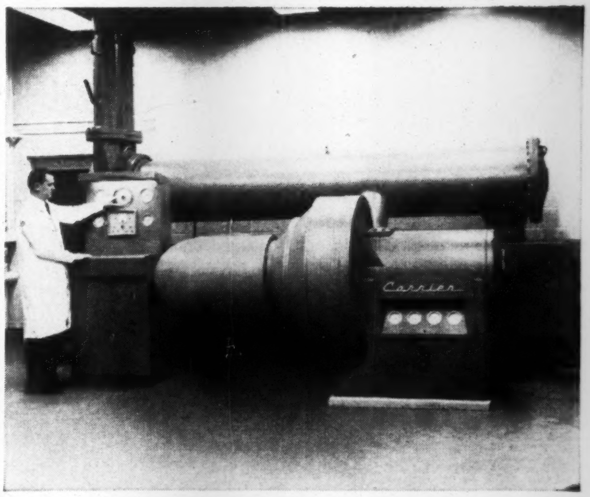
For example, one of the four types of refrigeration shown on the opposite page is best for your factory.

Only Carrier makes all four types and is able to give you an impartial recommendation. For complete information, call your nearest Carrier office. Or write Carrier Corporation, Syracuse, New York.

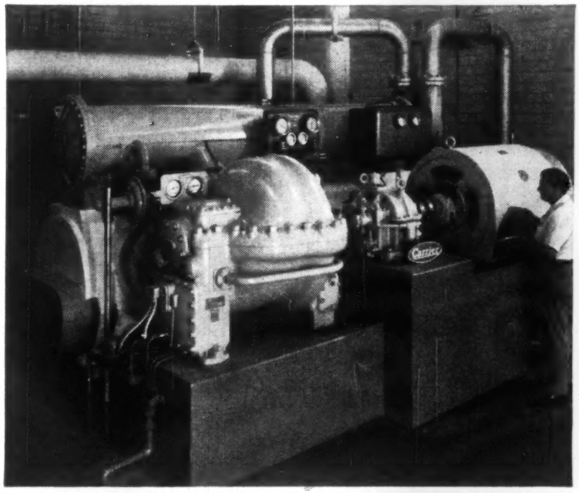
Carrier



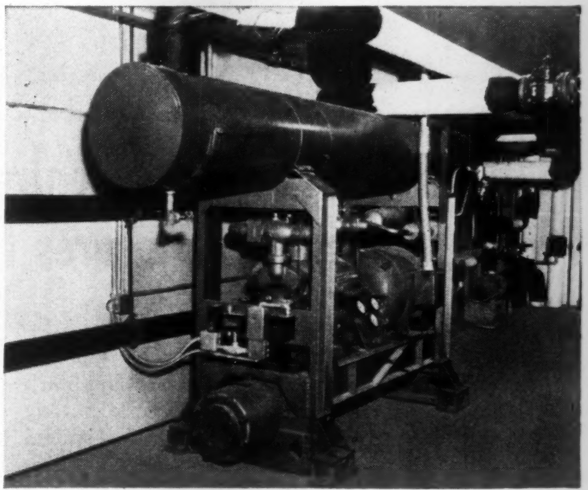
If you have low-cost steam, Carrier's new Absorption Refrigerating Machines may be best for you. They cool water for air conditioning and process refrigeration by using heat energy derived from low-pressure waste steam or hot liquids. If you have fluctuating loads, they will operate automatically from full load to zero capacity 24 hours a day, seven days a week. These dependable machines range in capacity from 60 to 700 tons.



If you have low-cost power, new Carrier Hermetic Centrifugal Refrigerating Machines may be your best answer. They're the only hermetics with such advanced features as a refrigerant-cooled motor, hydraulic-powered capacity vanes, and electronic self-contained controls for completely automatic operation. Their compactness and light weight minimize space and structural requirements. Capacities range from 90 to 1000 tons.

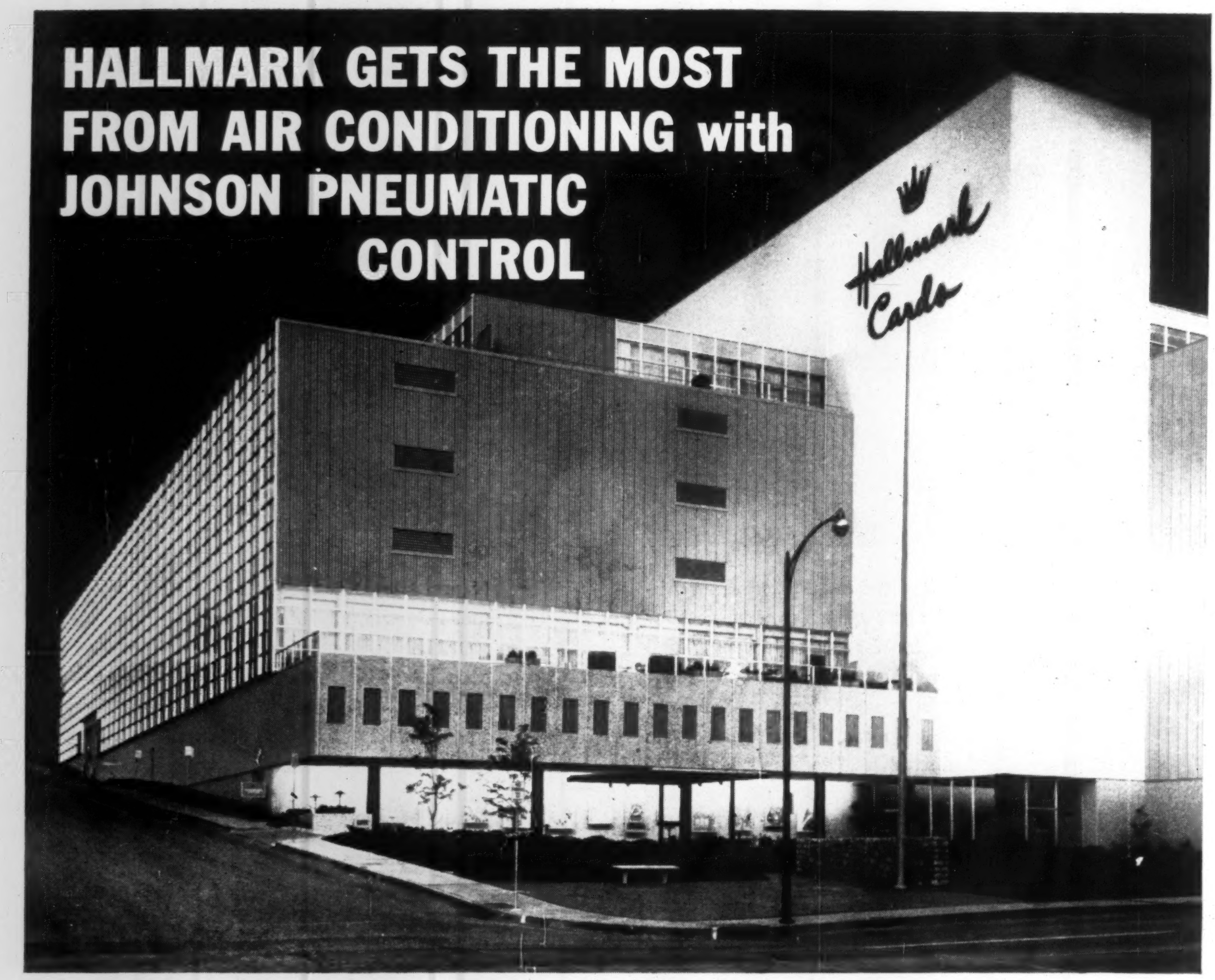


If you have heavy air conditioning requirements, or if you need sub-zero refrigeration, Carrier's famous external drive Centrifugal Refrigerating Machines are undoubtedly the best for you. With capacities to 4000 tons, they can serve the largest air conditioning system or chill liquids or brines as low as 150 degrees below zero for ultra-low manufacturing processes. Reliable and long-lived, these units are adaptable to many special drives.



If your factory is small, or if you have limited refrigeration requirements, Carrier Reciprocating Water Cooling Machines may be ideal for you. They're completely "packaged" with compressor, cooler, condenser and controls co-ordinated in design by Carrier engineers. Installation costs are lower and operating performance is more efficient than units assembled from unrelated components. Available in capacities ranging from 3 to 200 tons.

HALLMARK GETS THE MOST FROM AIR CONDITIONING with JOHNSON PNEUMATIC CONTROL



Hallmark Cards, Inc., Kansas City, Missouri. Welton Becket & Associates, architects and engineers; Long Construction Co., general contractor; Interstate Heating & Plumbing Co., mechanical contractors; all of Kansas City.

Multi-Purpose Pneumatic Control System Helps Solve Diversified Production Problems, Insures Made-To-Order Working Climate

Precision regulation of temperatures and humidities makes important contributions to production efficiency in the new air conditioned home of Hallmark Cards. The "brainwork" for the air conditioning system is done by a Johnson Pneumatic Control System that matches temperature and humidity conditions to the exact needs of the work carried on in each room and area of the 760,000 sq. ft. building.

Effective control has simplified numerous problems of handling temperature- and humidity-sensitive paper stock and helps make possible consistent, high speed, quality production of famous Hallmark greeting cards.

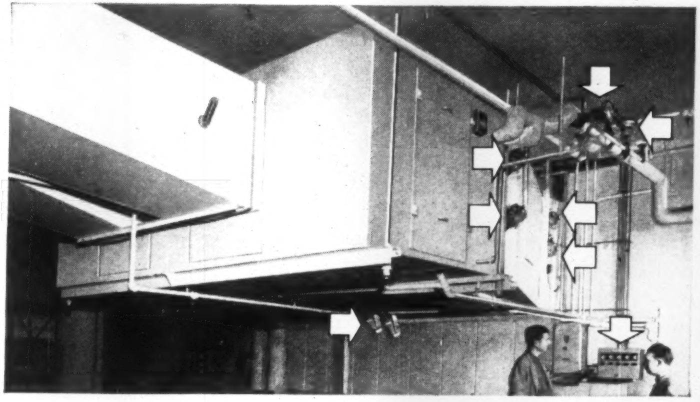
Equally important is the provision of an ideally controlled environment for Hallmark's creative staff and office employees.

Proper control of industrial air conditioning, heating and ventilating systems is becoming increasingly important as a means of improving production, cutting costs and adding to worker efficiency. Johnson's experience in planning and installing the pneumatic control systems of countless industrial buildings can be applied profitably to your problems. An engineer from a nearby branch office will gladly give you his recommendations without obligation. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

PLANNING • MANUFACTURING • INSTALLING • SINCE 1885



Conditioned air is supplied by 45 single-zone and 10 multi-zone units. Johnson equipment is shown above controlling outdoor air and return air dampers and hot and chilled water supplies on a typical production area unit. Space conditions are controlled by Room Thermostats and Room Humidostats.

Fast response to load shifts is a must in the 600-seat cafeteria. Sensitive Johnson Thermostats and Humidostats quickly compensate for changes in occupancy, hold temperature and humidity at ideal comfort levels. Stage and projection equipment permit the dining area to be used also for company functions.

Refreshing, perfectly regulated temperatures add to the efficiency of Hallmark's all-important creative staff. Many companies report that properly controlled air conditioning not only improves worker performance but helps reduce absenteeism and turnover and makes recruiting easier.

YOU CAN DO IT BETTER with JOHNSON PNEUMATIC CONTROL

1. Greater Simplicity—pneumatic control involves far fewer and much simpler components than anything else you can use.

2. Ease of Operation—inexpensive control pressure gauges, exclusive with pneumatic systems, give you unlimited freedom to observe and direct system operation.

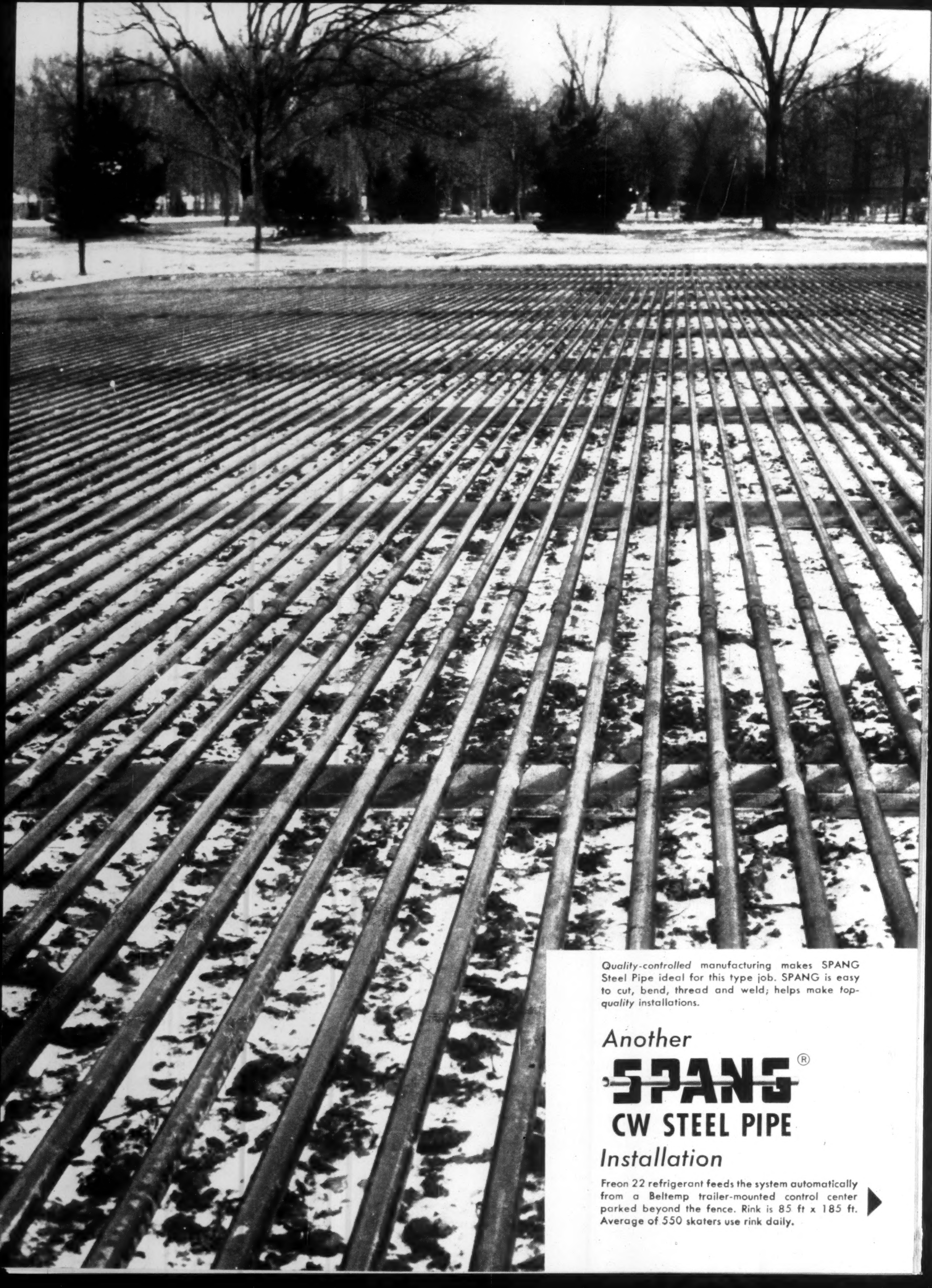
3. Choice of Features—widest choice of operating features to match your needs. Johnson makes the most complete line of pneumatic temperature, humidity and pressure control equipment.

4. Less Upkeep—there are fewer components to check, fewer parts subject to failure.

5. Reliable Performance—Johnson Pneumatic Control is unaffected by short circuits, electrical overloads, voltage variations and humidity. You get continuous, accurate control.

6. Complete Safety—even in the presence of explosive gases, solvents, dusts and other hazardous materials.

7. Maximum Flexibility—a big "plus" value in industrial work. No matter how exacting your needs, Johnson Pneumatic Control can produce the results required. It can be applied to any type or make of air conditioning, heating or ventilating system. Each Johnson System is engineered and installed to suit the requirements of the individual installation.



Quality-controlled manufacturing makes SPANG Steel Pipe ideal for this type job. SPANG is easy to cut, bend, thread and weld; helps make *top-quality* installations.

Another

SPANG®

CW STEEL PIPE

Installation

Freon 22 refrigerant feeds the system automatically from a Beltemp trailer-mounted control center parked beyond the fence. Rink is 85 ft x 185 ft. Average of 550 skaters use rink daily. ▶

"We specified SPANG® Steel Pipe because it's uniform, reliable and easy to work with"

—says Charles R. Beltz, Charles R. Beltz & Co., Detroit, Michigan

Outdoor Skating Rink at Dearborn, Michigan uses 48,280 ft of Spang Pipe

Regardless of temperature, there will be outdoor ice skating at the City of Dearborn's Levagood Park from November 15 through March 15, now that the SPANG Steel Pipe ice rink has been installed.

Costs for this rink were kept low in two ways. First, *quality-controlled* SPANG Steel Pipe was used. The 47,520 ft of 1" SPANG going into the grid was coupled with extra heavy couplings. Only larger sections required welding. SPANG's uniformity made it easy to work with, saved construction time. Pipe spoilage was unusually low.

Second, the new rink is operated automatically from a Beltemp trailer-mounted mobile freezing unit. Developed by Charles R. Beltz & Co., the trailer unit is rolled into place and coupled to rink grid during the skating season. In spring the rink piping is capped and the trailer moved into storage. By using the trailer, the cost of constructing a permanent building was eliminated.

Make quality installations with SPANG!

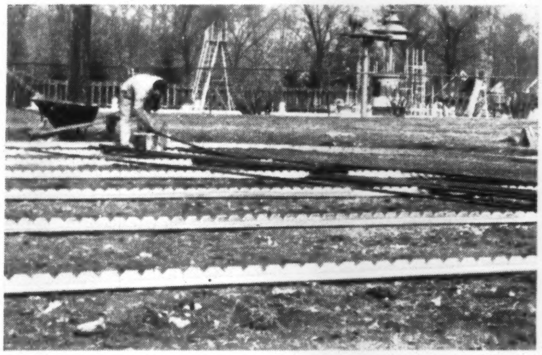
In any type of piping job, you'll get *top-quality* results with SPANG Steel Pipe. It's manufactured under closely controlled conditions and thoroughly tested and inspected before shipping.

SPANG's easy workability can help you keep construction costs down. Try it! Call your nearby SPANG Distributor for *top-quality* service!

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Offices:
Two Gateway Center, Pittsburgh, Pa.

SPANG® CW STEEL PIPE

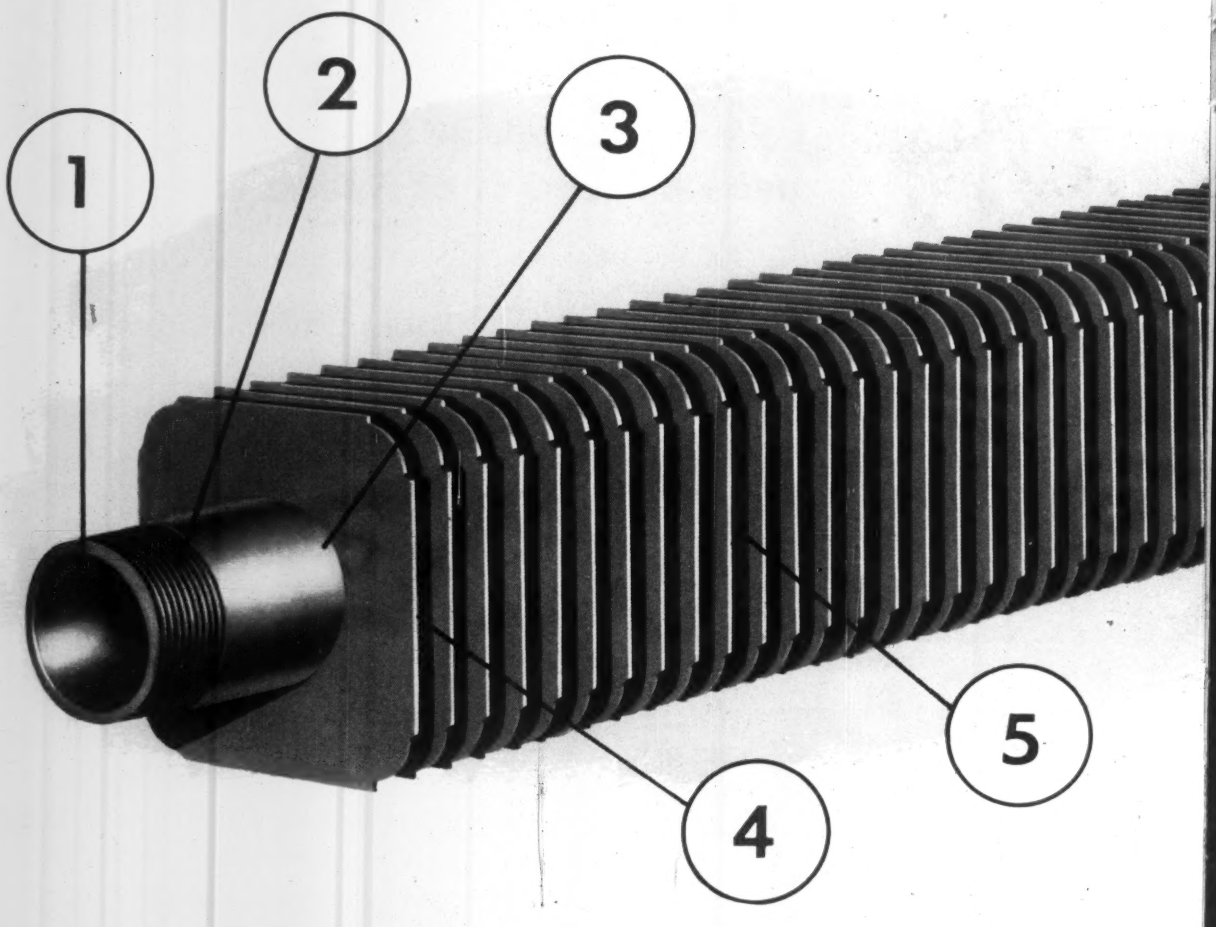
District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

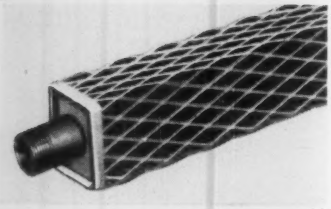


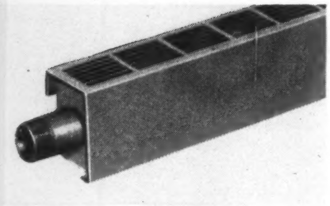
47,520 ft of SPANG 1" Pipe was placed on steel sleepers, then coupled with extra-heavy couplings to form grid. Uniform pipe construction saved installation time.

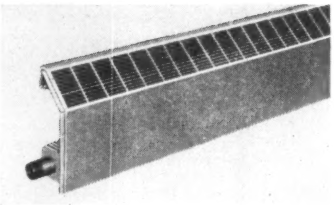
Completed grid is embedded in sand base. Next year after installation has settled, concrete base will replace sand to make installation permanent.

No heating problem too tough




expanded metal grille


flat top cover


sloping top enclosure

❶ **Fin and tube bond**—Temtrim fins are cut with the hole .004″ larger than the outside diameter of the tubing. After the fins are in place on the tube, the tube is expanded under pressure for permanent bond.

❷ **Threaded or chamfered ends**—Temtrim is available with threaded or chamfered ends. A stub of approximately 2½″ is provided at each end, giving ample room for quick joining.

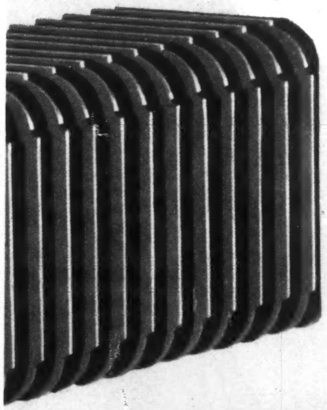
❸ **Tube**—Steel pressure tubing available in two sizes—1¼″ IPS with .135″ wall thickness or 2″ IPS with .148″ thickness. All Temtrim tubing is hydrostatically tested to withstand pressures up to 3,500 lbs. on 1¼″ size and 2,700 lbs. on 2″ size.

❹ **Fins**—Flat, platelike fins are fabricated of 20-gauge steel and cut to 3¼″ x 3¼″ size for 1¼″ tubing and 4¼″ x 4¼″ size for 1¼″ and 2″ tubing. The corners of the fins are rounded for safety in handling.

❺ **Fin spacing**—a variety of fin spacing is available with Temtrim to suit most installations. The 3¼″ fin size is available with 24 and 34 fins per lineal foot—the 4¼″ size with 28 and 36 fins per foot.

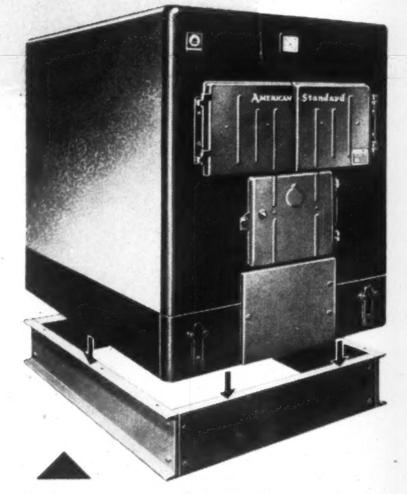
for AMERICAN-Standard

Take advantage of higher output, lower cost, faster installation for all your commercial and industrial hot water or steam heating jobs

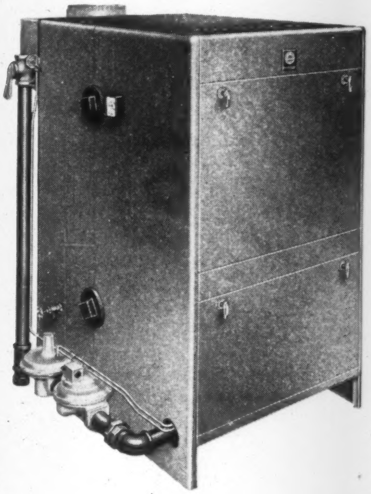


Dependable, versatile American-Standard cast iron boilers and radiation are a natural for landing new heating contracts in: schools, hospitals, factories, offices, churches, theaters and other commercial and industrial buildings. Designed especially for forced hot water and steam installations, they are economical and extremely fast to install. For example, Temtrim finned-tube radiation is a snap to assemble and easy to install on the wall. Extra-compact, it extends less than 5″ into the room. Gives your customers steady, even, clean heat without sudden drafts or cold spots. American-Standard cast iron boilers are durable, unfaltering performers, yet compactly designed and easy to handle. And the quality-famous Mark of Merit means fewer costly, time-wasting call-backs.

Cast to last-cast iron boilers by AMERICAN-Standard



A-7 cast iron oil boiler has exclusive, new steel pedestal base that cuts installation time and costs—5 to 12 cast iron section sizes factory-tested at 2½ times normal operating pressure—2,620 to 6,940 sq. ft. net I=B=R steam rating—4,330 to 11,110 sq. ft. net I=B=R water rating. Has tappings for external domestic water heater—battery installations for any size job—adaptable for gas and coal.



G-6 gas-fired A.G.A. approved boiler for steam or water—designed with rugged cast iron base for fast, low-cost installation—durable cast iron sections give long, dependable service—1,520 to 13,450 sq. ft. net I=B=R steam rating—2,615 to 21,520 sq. ft. net I=B=R water rating. A.G.A.-approved for all gases. Controls, valves and control piping factory-assembled—compact, stands only 65″ high—installed in battery for any heating requirement.

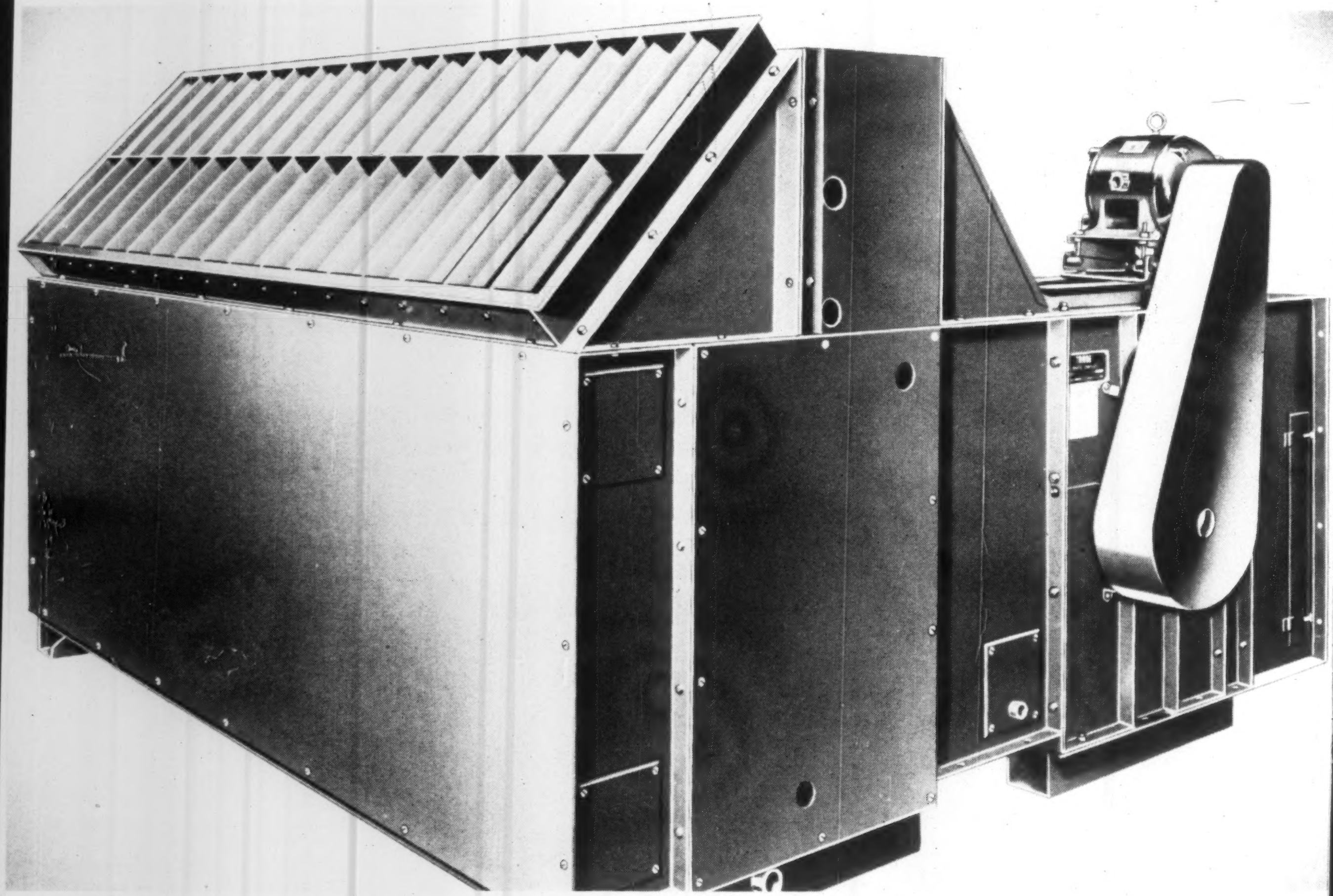
For added information on these versatile, dependable American-Standard heating products, call your nearest distributor or write: AMERICAN-STANDARD, PLUMBING & HEATING DIVISION, 40 W. 40th Street, New York 18, N. Y.

AMERICAN-Standard

PLUMBING AND HEATING DIVISION

AMERICAN-Standard PRODUCTS

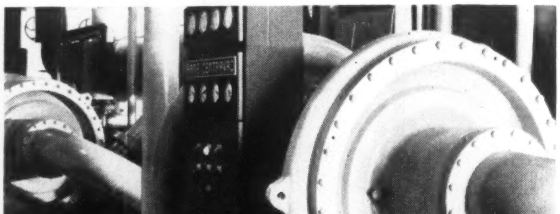
Different air conditions now yours with one



Any condition for any zone! Multi-Zone Climate Changer supplies any desired combination of heating, cooling, ventilating to as many as 25 zones. May also be used as heating and ventilating unit only (standard unit less cooling coil). Complete range of 9 sizes with capacities ranging from 1700 to 29,000 cfm of standard air.

Heat, cool, ventilate one zone with this standard TRANE Climate Changer. Meets the largest possible variety of air conditioning requirements. Horizontal or vertical units; capacities ranging from 600 to 29,000 cfm.

Cut power costs with the TRANE CenTraVac water chiller—the industry's *first* hermetic centrifugal. Automatically throttles down to 10% of capacity or less. Complete range of sizes to 1500-ton units.



for 25 zones Trane Climate Changer!

Multi-Zone units supply complete air conditioning...or any combination of heating, cooling, ventilating. A different climate for each zone, at the same time!

Here's the ideal air conditioner for many buildings where individual units in each zone would be too costly. It's the TRANE Multi-Zone Climate Changer—a unit designed to supply *independent and variable* control of conditioning for as many as 25 zones, each with different requirements!

The TRANE Multi-Zone Climate Changer is especially suitable for those buildings where one or more zones may require maximum cooling while, at the same time, other zones require less cooling—or may even need *heating.*

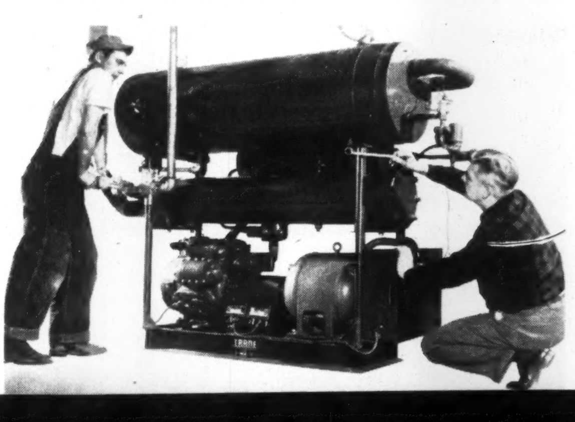
Whatever the individual zone requirements may be, the TRANE Multi-Zone Climate Changer does the job! This versatile, rugged unit supplies complete air conditioning . . . cooling only . . . heating only . . . cooling and ventilating . . . heating and ventilating . . . heating and humidification . . . or ventilating only for in-between seasons—for as many as 25 zones. Each zone can have a different climate *at the same time!* And the Climate Changer furnishes a *constant quantity* of conditioned air at the temperatures required in each zone.

Want more facts? See your nearby TRANE Sales Office, or write TRANE, La Crosse, Wis.

Check these Climate Changer features:

- Provides different air conditions for as many as 25 zones simultaneously.
- Furnishes constant volume of air at varying temperatures . . . does not accomplish temperature control by varying air quantities.
- Centralizes all piping and controls in one location.
- Eliminates use of reheat coils and their controls in the individual zone ducts.
- Enables the use of *one* source of chilled water or refrigerant for DE coils.
- Full-length damper section for each full-length coil smooths out air flow, allows for better air distribution.
- Size and number of zones can be changed on the job.
- Unusually rugged, *sectionalized* construction.

Factory pre-assembly of the TRANE Cold Generator cuts installation time, reduces costly call-backs. Requires only simple water and electrical connections. All components engineered to work together! Capacities to 150 tons.



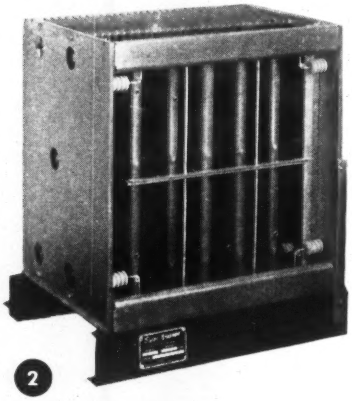
For any air condition, turn to

TRANE

**MANUFACTURING ENGINEERS OF AIR
CONDITIONING, HEATING, VENTILATING
AND HEAT TRANSFER EQUIPMENT**

THE TRANE COMPANY, LA CROSSE, WIS. • EASTERN MFG. DIV., SCRANTON, PA. •
TRANE COMPANY OF CANADA, LTD., TORONTO • 90 U.S. AND 19 CANADIAN OFFICES

1



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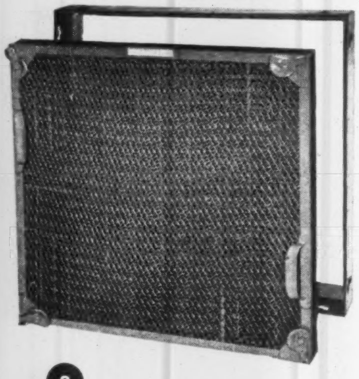

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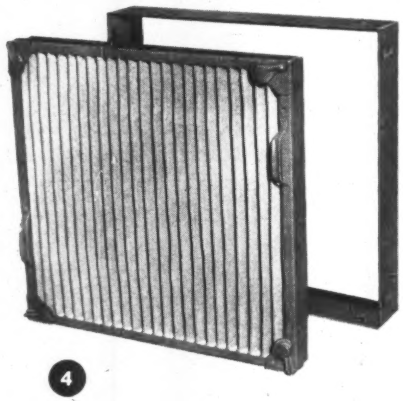


4

Which Staynew Filter for Your Air Filtration Job?

Among the complete line of industrial and ventilating filters offered by Dollinger, you will find one that meets your requirements, exactly. Illustrated are:

1. **Staynew Automatic Air Filter**—A hands-off, self-cleaning filter for heavy duty application that reduces maintenance costs and shut-down time to a minimum. An exclusive feature provides double filtering action . . . positive protection against oil entrainment in the air stream. Write for Bulletin 500.
2. **Electro-Staynew Precipitator**—Removes 90% of all air-borne dirt, smoke, dust, pollen and oil mist. A completely self-contained unit. Write for Bulletin 400.
3. **Viscous Panel Filter**—Low cost, permanent, washable . . . for locations where extreme efficiency is not required. Large capacity, easy to clean. Write for Bulletin 700.
4. **Dry Panel Filter**—Highly efficient for heavy duty work. Preformed filtering material quickly and easily changed. Write for Bulletin 600.

Write for Bulletins which describe in detail the filters illustrated. We also design all types of special filters. Consult Dollinger engineers . . . no obligation. Dollinger Corporation, 9 Centre Park, Rochester 3, N. Y.

REG. PROTECTOMOTOR U.S. PAT. OFF.

AFI MEMBER AIR FILTER INSTITUTE

STAYNEW **DOLLINGER**

FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

JALZINC is J&L's superior quality zinc coated steel

JalZinc is produced on this modern Sendzimir continuous galvanizing line. JalZinc has a tight, uniform coating that resists cracking and flaking. The uniform ductility, flatness and a high luster surface finish improve your product appearance.

JalZinc is available in a wide range of gages and widths in both cut lengths and coils. It can be furnished in coating weights from 1.00 oz. to 2.50 oz. per sq. ft., depending on your end product needs.

Get details from your local J&L district office or write to the Jones & Laughlin Steel Corporation, Dept. 518, 3 Gateway Center, Pittsburgh 30, Pa. For out of stock requirements, call your local steel warehouse or sheet metal distributor.

J L STEEL

Jones & Laughlin

...a great name in steel

Jenni Genetron says:

For refrigerants that are Super-Dry
Always be sure to specify...

genetron

SUPER-DRY REFRIGERANTS

Tops in quality . . . Tops in performance

Available from wholesalers everywhere.

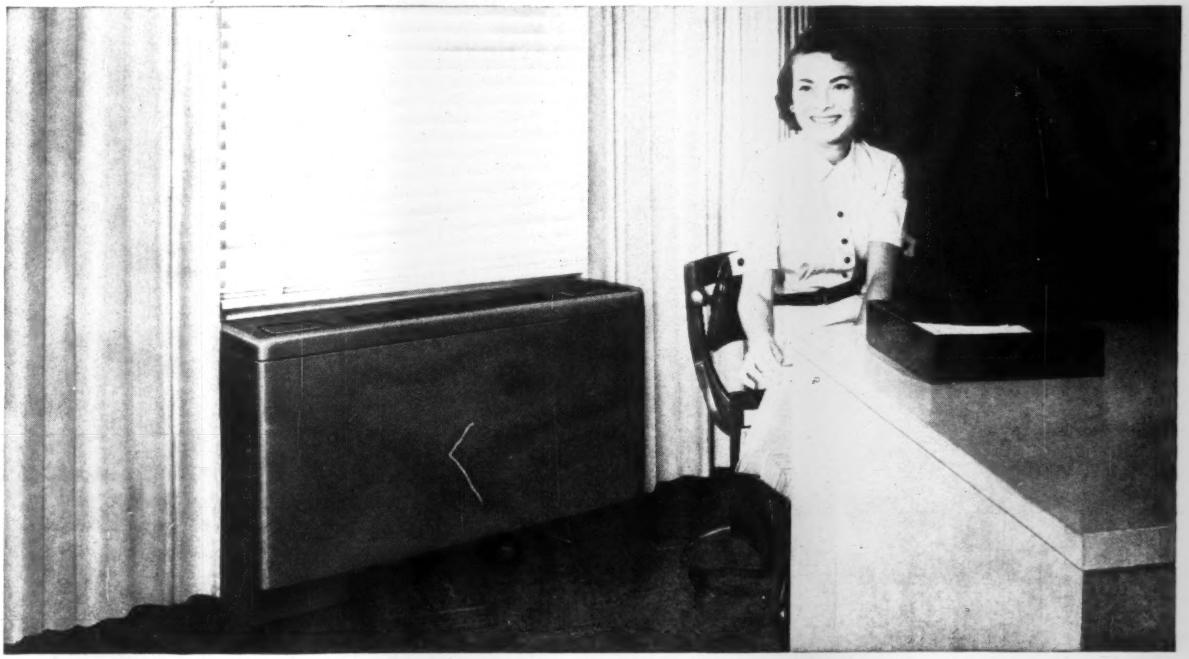
genetron 12 WHITE LABEL **DICHLORODIFLUOROMETHANE**
genetron 22 GREEN LABEL **MONOCHLORODIFLUOROMETHANE**
genetron 11 ORANGE LABEL **TRICHLOROMONOFLUOROMETHANE**
genetron 113 PURPLE LABEL **TRICHLOROTRIFLUOROETHANE**
genetron 114A BLUE LABEL **DICHLOROTETRAFLUOROETHANE**

See Your Wholesaler

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

genetron 12
WHITE LABEL
GENERAL CHEMICAL DIVISION
genetron 22
GREEN LABEL
GENERAL CHEMICAL DIVISION
genetron

THE NEW *Airtherm* AIR CONDITIONING UNIT



COMBINES THE BEST TIME-PROVED FEATURES IN THE INDUSTRY

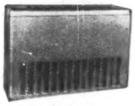
FOR NEW OR EXISTING

- ✓ OFFICES
- ✓ MOTELS
- ✓ HOTELS
- ✓ APARTMENTS
- ✓ INSTITUTIONS
- ✓ PUBLIC BUILDINGS

Here is Airtherm's answer to the demand for remote air conditioning without expensive ductwork. Features that have performed best in actual usage through the years are combined in this unit to give: (1) Maximum efficiency and operating life; (2) Quiet operation; (3) Versatility of installation; (4) Attractive appearance that blends with new or old buildings.

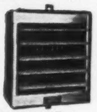
Airtherm units are made in four series from ½ to 2 ton nominal cooling capacity for cabinet or concealed installation, floor or ceiling.

AIRTHERM HEATING AND VENTILATING PRODUCTS

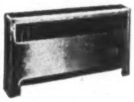


Cabinet
Unit Heater

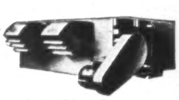
Gas Fired
Unit Heater



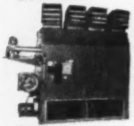
Propeller Fan
Unit Heater



Convector



Centrifugal Fan
Unit Heater



Direct Fired
Space Heater

MAIL COUPON FOR DETAILS

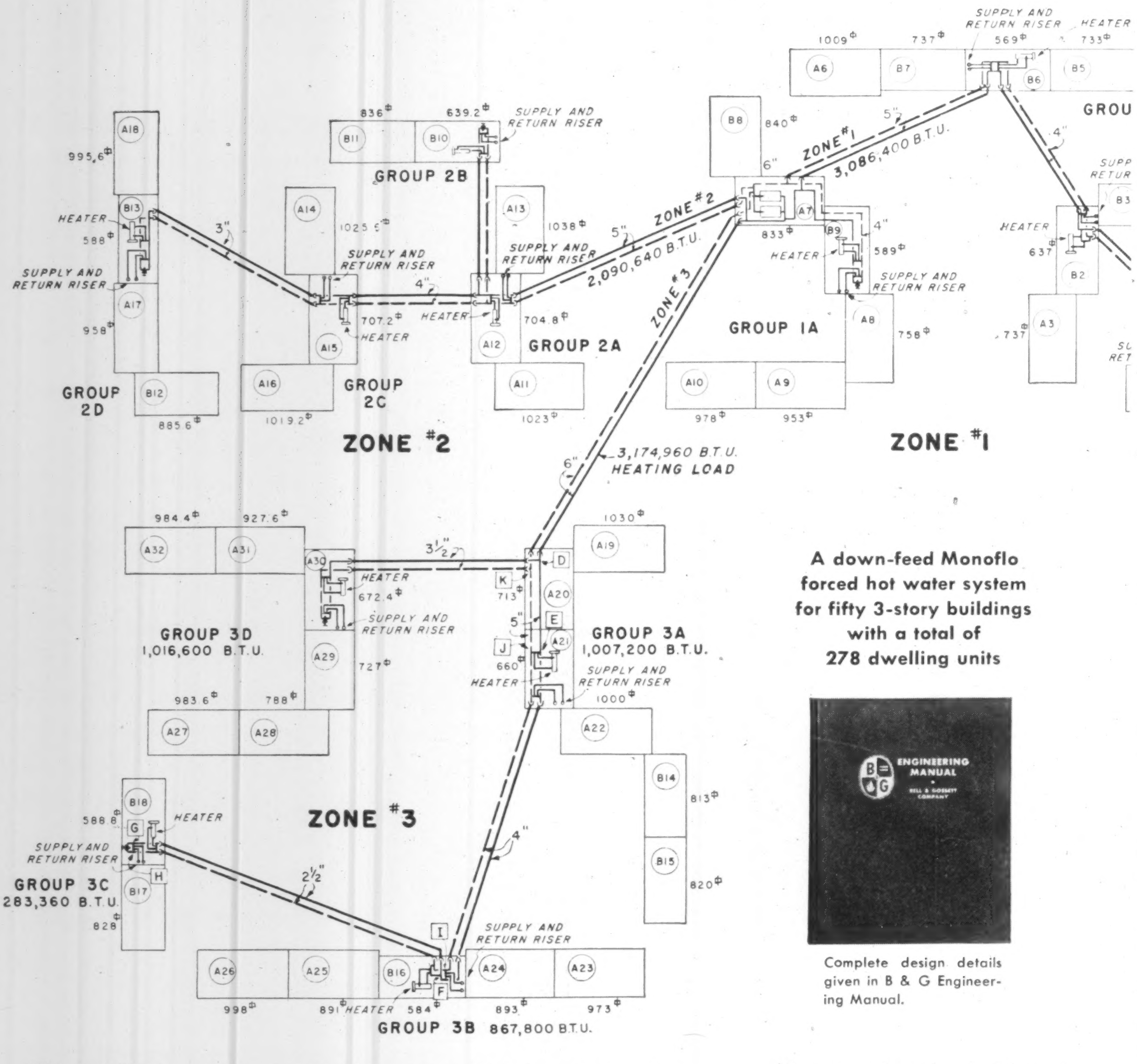
Airtherm Manufacturing Co., Dept. A
700 S. Spring • St. Louis 3, Mo.

Please send specifications on the following products as checked ☐ Airtherm Air Conditioning Units ☐ Cabinet Unit Heaters ☐ Convectors ☐ Gas Fired Unit Heaters ☐ Propeller Fan Unit Heaters ☐ Centrifugal Fan Unit Heaters ☐ Direct Fired Space Heaters.

NAME ....FIRM ....

STREET ADDRESS .... CITY .... STATE ....

STUDIES IN FORCED HOT WATER


SUPPLY AND RETURN RISER
HEATER
1009
737
569
733
A6
B7
B6
B5
GROU
B8
840
6"
ZONE #1
5"
3,086,400 B.T.U.
4"
836
639.2
B11
B10
GROUP 2B
A18
995.6
B13
HEATER
588
SUPPLY AND RETURN RISER
A17
958
3"
A14
1025.5
SUPPLY AND RETURN RISER
4"
707.2
HEATER
A15
A16
1019.2
GROUP 2C
A13
1038
SUPPLY AND RETURN RISER
5"
ZONE #2
2,090,640 B.T.U.
704.8
A12
GROUP 2A
A11
1023
ZONE #3
A7
833
B9
HEATER
589
SUPPLY AND RETURN RISER
GROUP 1A
A8
758
A10
A9
978
953
HEATER
637
B3
B2
A3
737
GROUP 2D
B12
885.6
ZONE #2
6"
3,174,960 B.T.U. HEATING LOAD
ZONE #1
984.4
927.6
A32
A31
A30
3½"
HEATER
672.4
SUPPLY AND RETURN RISER
GROUP 3D
1,016,600 B.T.U.
A29
727
983.6
788
A27
A28
D
K
713
A19
1030
A20
5"
E
J
660
HEATER
A21
GROUP 3A
1,007,200 B.T.U.
SUPPLY AND RETURN RISER
1000
A22
B14
813
B15
820
ZONE #3
4"
B18
588.8
G
HEATER
SUPPLY AND RETURN RISER
H
B17
GROUP 3C
283,360 B.T.U.
828
2½"
I
SUPPLY AND RETURN RISER
A26
A25
B16
F
A24
A23
998
891
HEATER
584
893
973
GROUP 3B 867,800 B.T.U.

A down-feed Monoflo forced hot water system for fifty 3-story buildings with a total of 278 dwelling units

B G
ENGINEERING MANUAL
BELL & GOSSETT COMPANY

Complete design details given in B & G Engineering Manual.

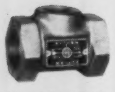
This installation employs a single boiler room with two boilers and a piping design calling for continuous circulation through primary trunk mains, divided into three zones. Each of the twelve building groups is served by secondary Monoflo mains, circulated by a secondary pump.

Domestic water is heated in tankless heaters with water taken off a by-pass in the primary mains and circulated by another secondary pump.

This arrangement, as opposed to multiple boiler plants, offers a more efficient and economical layout. Maintenance is centralized and the need for running separate domestic hot water lines eliminated. It also permits local control in each building group. These considerations, plus the lower first cost of boilers, pumps and auxiliary equipment, make the central plant the logical choice.

Complete design details for this installation are given in the B&G Engineering Manual. See your local B&G Representative for a copy.

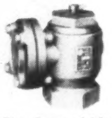
A COMPLETE LINE OF EQUIPMENT FOR HEATING AND COOLING WITH WATER



Monoflo Fittings

Relief and Reducing Valves

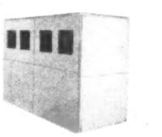
Water Heaters



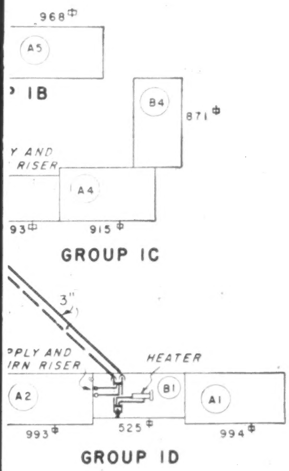
Flo-Control Valves

Compression Tanks

Package Liquid Coolers



HEATING SYSTEM DESIGN


968
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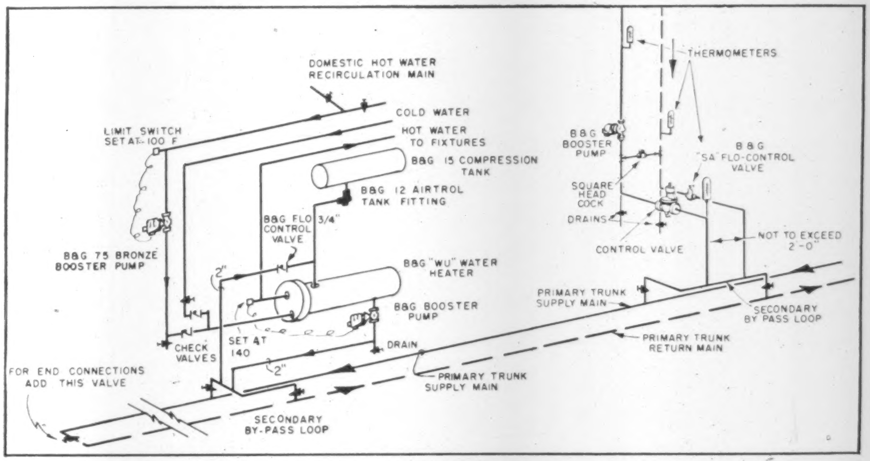

DOMESTIC HOT WATER RECIRCULATION MAIN
COLD WATER
LIMIT SWITCH SET AT 100 F
HOT WATER TO FIXTURES
B&G 15 COMPRESSION TANK
B&G 12 AIRTROL TANK FITTING
B&G FLO CONTROL VALVE
3/4"
B&G 75 BRONZE BOOSTER PUMP
2"
B&G "WU" WATER HEATER
B&G BOOSTER PUMP
CHECK VALVES
SET AT 140
DRAIN
2"
FOR END CONNECTIONS ADD THIS VALVE
PRIMARY TRUNK SUPPLY MAIN
SECONDARY BY-PASS LOOP
THERMOMETERS
B&G BOOSTER PUMP
B&G "SA" FLO-CONTROL VALVE
SQUARE HEAD COCK
DRAINS
CONTROL VALVE
NOT TO EXCEED 2'-0"
PRIMARY TRUNK SUPPLY MAIN
SECONDARY BY PASS LOOP
PRIMARY TRUNK RETURN MAIN

Typical secondary heating and domestic hot water supply station in each building group.

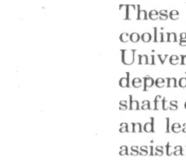
B & G UNIVERSAL AND BOOSTER PUMPS

...for QUIET operation in heating and cooling systems

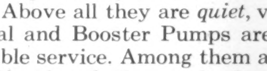
These pumps satisfy the most exacting requirements of circulated water systems for heating and cooling. Above all they are *quiet*, vibrationless...the prime essential of a circulating pump. B&G Universal and Booster Pumps are distinguished by numerous features which assure years of dependable service. Among them are the specially built motors, tested for quietness...oversized shafts of hardened alloy steel...long sleeve bearings...silent spring-type couplers...oil lubrication and leak-proof mechanical seals. These pumps are backed by a manufacturer equipped to give assistance in any problem of design or installation and whose distributors maintain adequate stocks to serve your needs.

The fact that well over 2,000,000 B&G Booster and Universal Pumps are in operation today is ample evidence that their quality has never been challenged.

For a complete description of the features which have made these units the *preferred* pumps, send for Bulletins IA-856 and HQ-856.



Centrifugal Pumps



Evaporators and Condensers

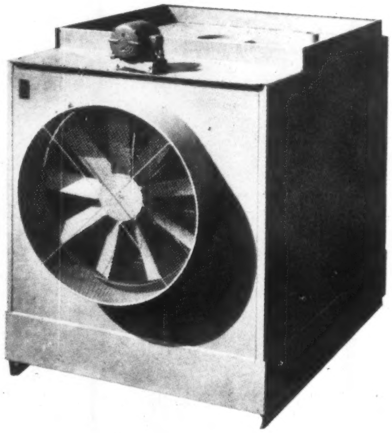
BELL & GOSSETT COMPANY

Dept. EV-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

2 ways to win friends and influence customers...

1 Take 'em to Chez Paree



2 Sell Marley Aquatowers*

The performance of the chorus line may make its momentary impression on your customer—but the performance of a Marley Aquatower will make him a lifetime "booster" for your company! For Aquatowers are designed to insure *lasting* satisfaction. They are built with an eye to the future, as evidenced by their heavy-gauge steel casing . . the life-time filling . . . the specially designed mechanical equipment.

No need to take our word for it—ask any contractor who has "tried 'em all." He'll tell you that nothing cools water like a Marley Aquatower . . . that its service life is longer . . . that its day-in-day-out performance is more dependable. He may also add that you never have to overbuy or overload when you buy Aquatowers, since Marley makes the world's most complete line of packaged cooling towers.

All the technical details of the Aquatower line are contained in our new Bulletin AQ. Just ask your Marley supplier in any of 300 cities for a copy, or write direct.

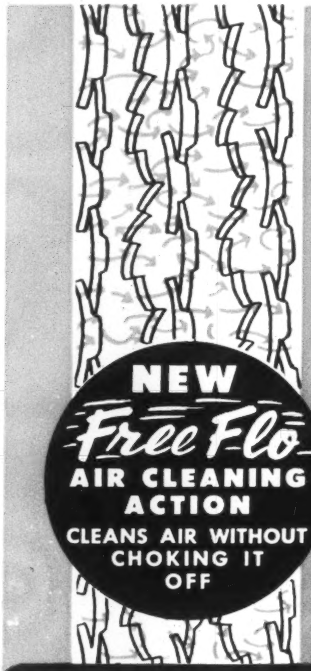
*Registered Trade Name

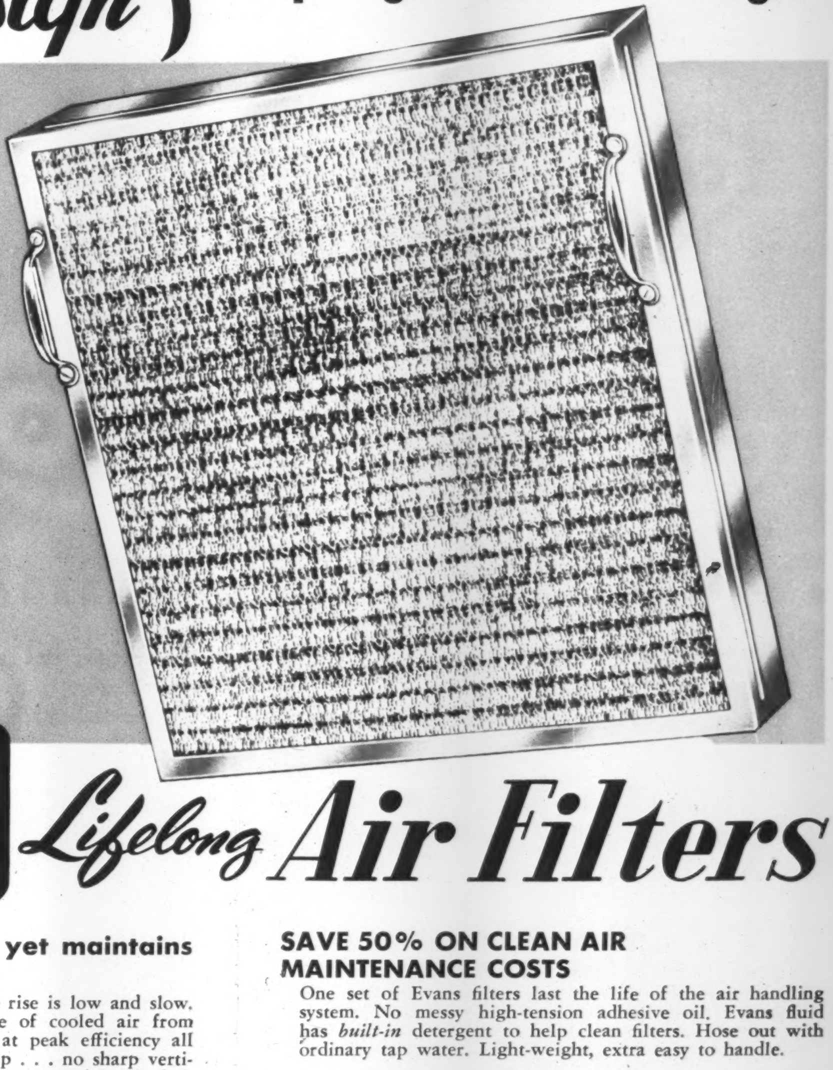
MARLEY®

The Marley Company Kansas City 14, Missouri

NEW *Filter Design*

29% SLOWER RESISTANCE RISE ...per gram of dirt caught


NEW
Free-Flo
AIR CLEANING ACTION
CLEANS AIR WITHOUT CHOKING IT OFF



Evans *Lifelong* *Air Filters*

Super cleans the air . . . yet maintains FULL FLOW AIR DELIVERY

As filter loads, rate of static pressure rise is low and slow. Low resistance permits faster release of cooled air from cooling coils. Thus blower delivers at peak efficiency all during cooling cycle. No sudden jump . . . no sharp vertical rise in resistance. Air delivery system remains in balance. Resistance rise is slow even from 0.50″ water gauge to 1.00″ or 1.50″ water gauge. High lint (or fibrous material) content in the air does not change this performance.

BIG CAPACITY DESIGN

Enables Evans filter to catch and hold lint without choking off air stream (particularly desirable in super markets, department stores, hospital, textile plants, and so forth where there is high lint content in the air).

EXTRA HEAVY LIFETIME CONSTRUCTION

All aluminum (heavy gauge). Every part precision made—precision assembled.

SAVE 50% ON CLEAN AIR MAINTENANCE COSTS

One set of Evans filters last the life of the air handling system. No messy high-tension adhesive oil. Evans fluid has *built-in* detergent to help clean filters. Hose out with ordinary tap water. Light-weight, extra easy to handle.

MAIL COUPON FOR FREE LITERATURE

THE GEORGE EVANS CORP. • Moline, Illinois

Gentlemen: Rush me full details on the NEW HIGH CAPACITY EVANS FILTER that has a 29% slower static pressure rise per gram of dirt caught.

NAME

COMPANY

ADDRESS

CITY STATE

It costs no more to buy the best . . .

Buy WOLVERINE...

How do you tell the best?

Well, we can't answer for other products but where tubing is concerned we know you can't do better than specify the products of Wolverine Tube. Here's why.

Wolverine products are Tubemanship built—reflect Wolverine's years of experience, rigid quality control, constant research, sound engineering and the pride its skilled employees take in work well done. The result is tubing of the highest quality and when you buy quality you automatically buy the best.

In addition to top quality, Wolverine Tubemanship also assures you of tubing designed to meet your needs. In heat transfer applications, for example, you can specify condenser tubing in two distinct forms. For heat exchange operations demanding top BTU output Wolverine manufactures Wolverine Trufin®—the integrally finned condenser tube. Also available is prime surface condenser tubing in a wide range of sizes and alloys. Wolverine is also widely known for its top quality commercial tube which is available in types for a wide variety of industrial applications.

The next time you require copper tubing specify Wolverine—and be sure of the best. For the complete story of Wolverine's extensive product line write for your copy of the General Products Catalog. Do it today!

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WOLVERINE TUBE DIVISION
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CANADA VULCANIZER AND EQUIPMENT COMPANY LIMITED

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

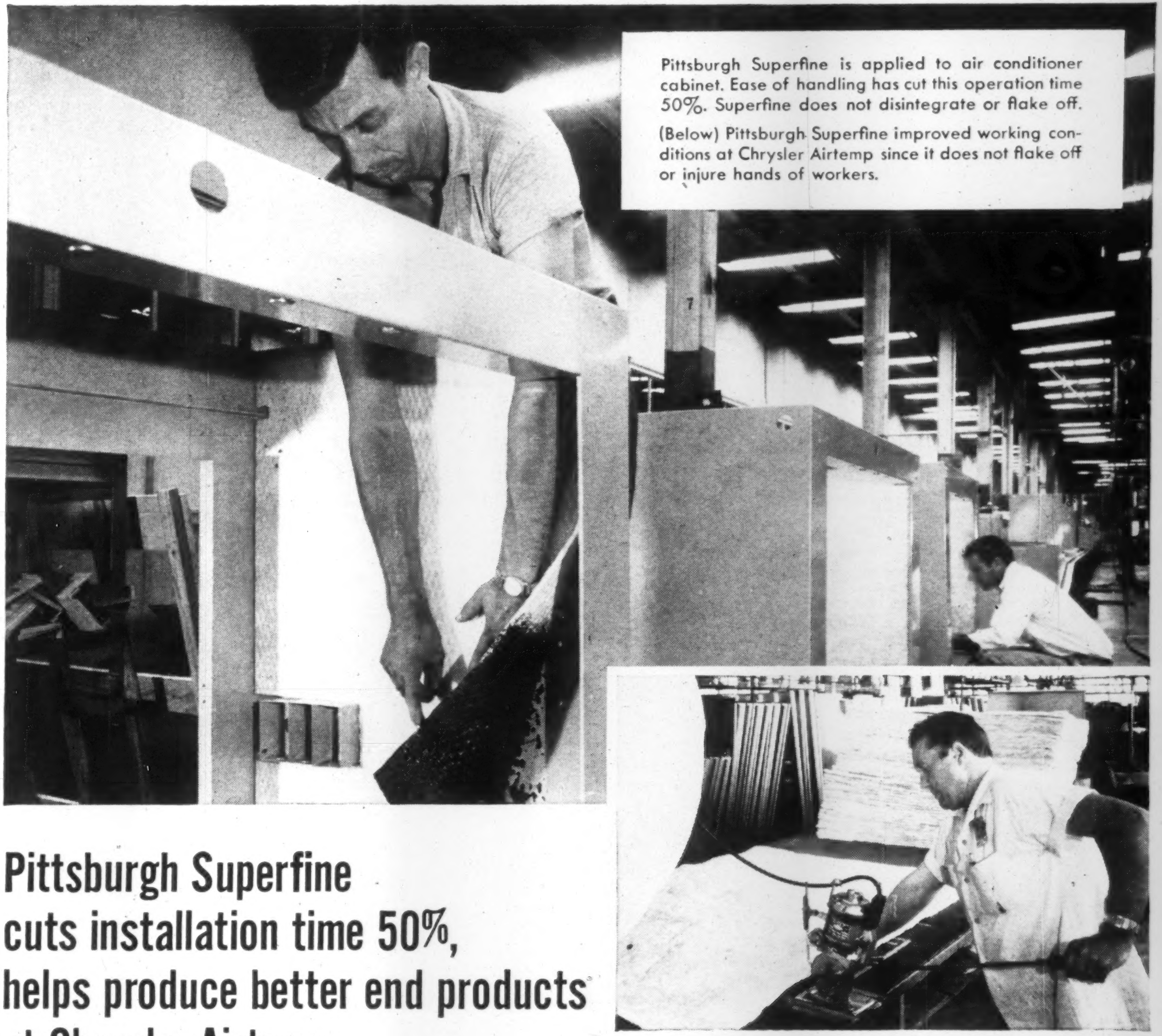
1461 CENTRAL AVE., DETROIT 9, MICH.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK



Pittsburgh Superfine is applied to air conditioner cabinet. Ease of handling has cut this operation time 50%. Superfine does not disintegrate or flake off.

(Below) Pittsburgh Superfine improved working conditions at Chrysler Airtemp since it does not flake off or injure hands of workers.

Pittsburgh Superfine cuts installation time 50%, helps produce better end products at Chrysler Airtemp

Production requirements at the Airtemp Division of Chrysler Corporation, Dayton, Ohio call for a flexible, well-bonded, efficient glass fiber insulation for air conditioning and heating units to prevent condensation or heat transfer at metal cabinet walls. Pittsburgh Superfine fulfills these requirements.

Glass fiber insulation previously used flaked off, would be ejected by the air stream. Measures improvised to correct this were costly and added production time.

But PPG Superfine, being specially bonded, avoided this disintegration. Superfine prevents condensation on cabinet walls and eliminates excessive temperature rise in heating unit enclosures.

Easier handling, too!

The rigid, brittle glass fibers of the material previously used caused dangerous cuts on workers' hands, despite heavy gloves. The old material was hard to position during assembly.

Now with Pittsburgh Superfine, installation time is cut in half. Superfine is flexible, easy to handle, does not flake off or cause cuts. Working conditions are much improved.

What can Pittsburgh Superfine do for you?

Pittsburgh Superfine offers you top insulating results in heat or cold applications . . . and in sound deadening, too! Find out about all its advantages. Then give it a try. For more information, write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

FIBER PPG GLASS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

HOW YOUR PROJECT BENEFITS FROM

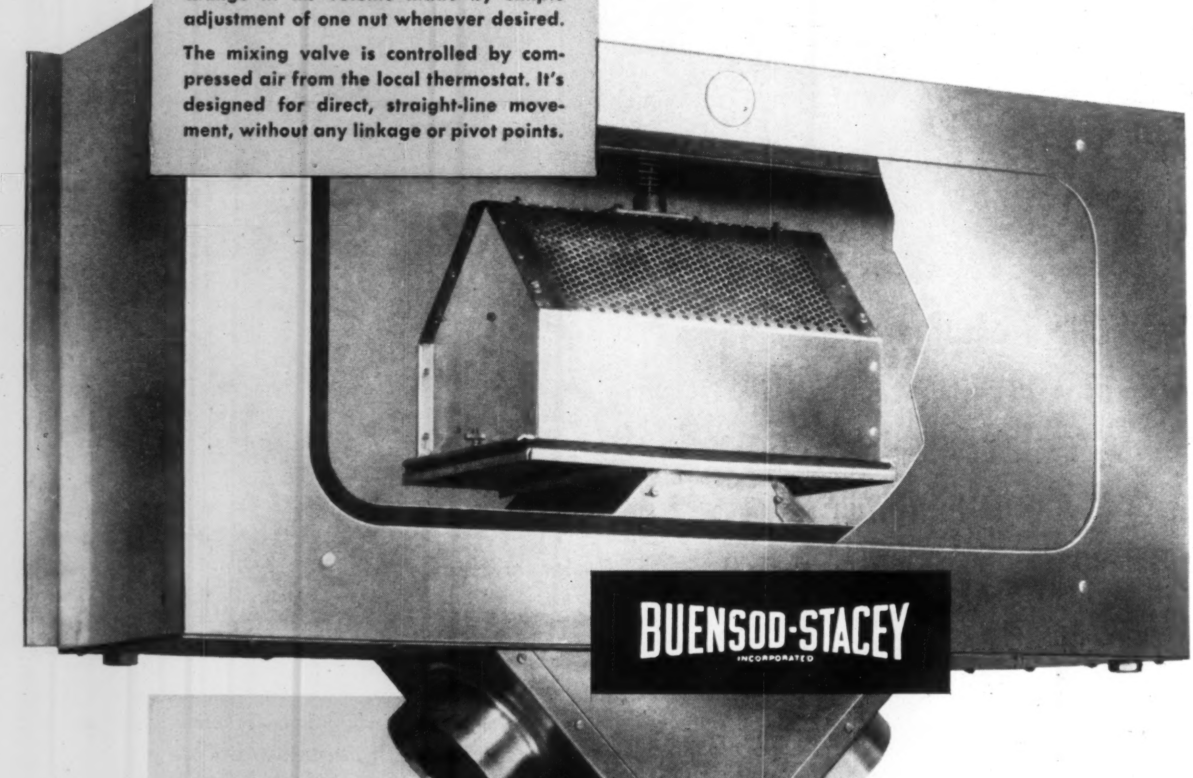
DIRECT, AUTOMATIC, VOLUME CONTROL

Direct volume control without the use of a sensing instrument is exclusive in Buensod Dual-Duct air mixing units.

Buensod volume regulators maintain constant air quantity through each unit, regardless of variance of static pressures on either inlet or outlet of mixing valve.

Also: Independent of outside source of power such as compressed air or electricity . . . no control instrument to calibrate; nothing but a screw adjustment of spring tension . . . can be factory-set for desired volume and guaranteed within 5%, plus or minus that amount, when installed . . . change in air volume made by simple adjustment of one nut whenever desired.

The mixing valve is controlled by compressed air from the local thermostat. It's designed for direct, straight-line movement, without any linkage or pivot points.



BUENSOD-STACEY
INCORPORATED

Buensod units are being installed in more and more structures — new and renovated. Consider them for your next project!

BUENSOD-STACEY, Inc.
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Davenport, Iowa, D. C. Murphy Co.
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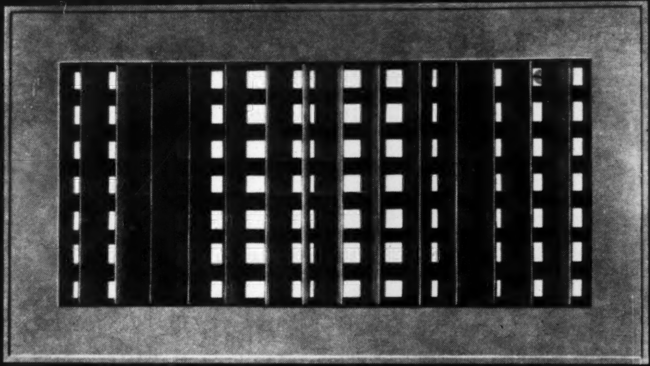
The No. 190 U. S. MULTI-FLEX LINES HAVE EVERYTHING YOU'VE LOOKED FOR

— PERFECT AIR-DIRECTION . . . MINIMUM RESISTANCE . . . BEAUTIFULLY FORMED SHADOW-LESS MARGINS

THEIR SILENT-AIR STREAMLINED GRILLE BARS ELIMINATE AIR SOUNDS Prevalent in other types of Bar Construction

No. 190 U.S. MULTI-FLEX REGISTER

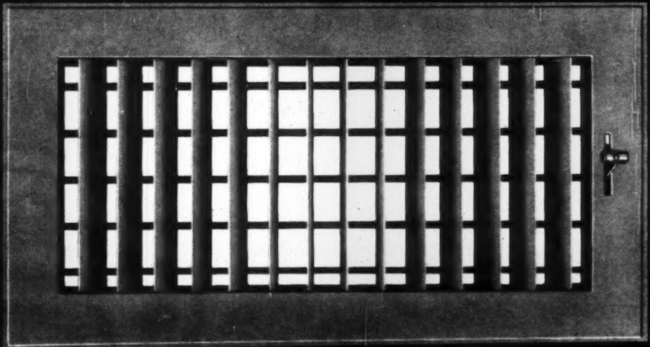


DOUBLE BANKS of STREAMLINED GRILLE BARS GIVE any varied Directions of UP-FLOW or DOWN-FLOW — and LATERAL FLOWS DESIRED.

OPPOSED REAR VALVES (AN ORIGINAL U. S. PATENTED FEATURE) Are SCREW-DRIVER OPERATED — No Loose Keys — ANOTHER U. S. ORIGINAL PRESENTATION.

No. 190 — Vertical Front —
Horizontal Rear Bars
No. 191 — Horizontal Front —
Vertical Rear Bars
Also other STYLES for Every Requirement

No. 192-L—U.S. MULTI-FLEX REGISTER



ONE SINGLE BANK of STREAMLINED VERTICAL GRILLE BARS. May be Set to give any desired DIRECTION of LATERAL AIR FLOW.

LEVER-OPERATED PARALLEL VALVES Control AIR VOLUME and also Direct Up Flow or Down Flow of AIR.

The No. 192-L Has a shallow Valve Assembly. Ideal also for Residential Heating and Cooling as it can be used in Studding Spaces.

ALSO VERY COMPETITIVELY PRICED

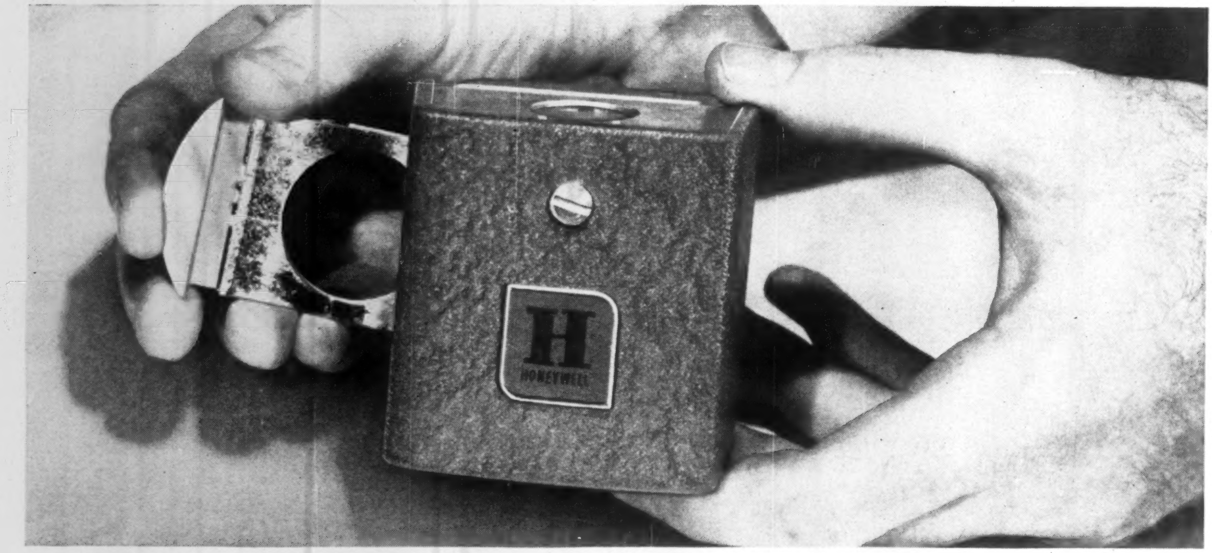
WRITE NOW FOR NO. 556-R CATALOG for the Finest of ALL COMMERCIAL REGISTERS, GRILLES, and AFFILIATED Lines

U. S. MULTI-FLEX and NON-FLEX REGISTERS and GRILLES
Designed for the FINEST CONSTRUCTION

UNITED STATES REGISTER COMPANY
BATTLE CREEK, MICHIGAN
MINNEAPOLIS • KANSAS CITY • ALBANY
SOLD BY LEADING JOBBERS FROM COAST TO COAST

New from Honeywell

Miniaturized Photocell Mount!



Easily removable slide-glass window on the new Honeywell C7010-A makes for easy maintenance.

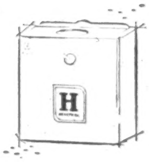
NOW SMALLER and more compact, this externally-mounted unit was specially designed for smaller industrial-commercial oil burners. It utilizes a 1¼-inch pipe mount for pressure-tight connections.

Servicing the new Honeywell C7010-A Flame Rectifier is easy. Externally mounted, with an easily removable cover, the photocell is conveniently accessible for servicing. The photocell window can be slid out, wiped clean and reinserted in seconds.

These other important features assure superior performance:

- **Built-in heat block** • **Pressure-ventilated**
- **Underwriters' Laboratories approved**

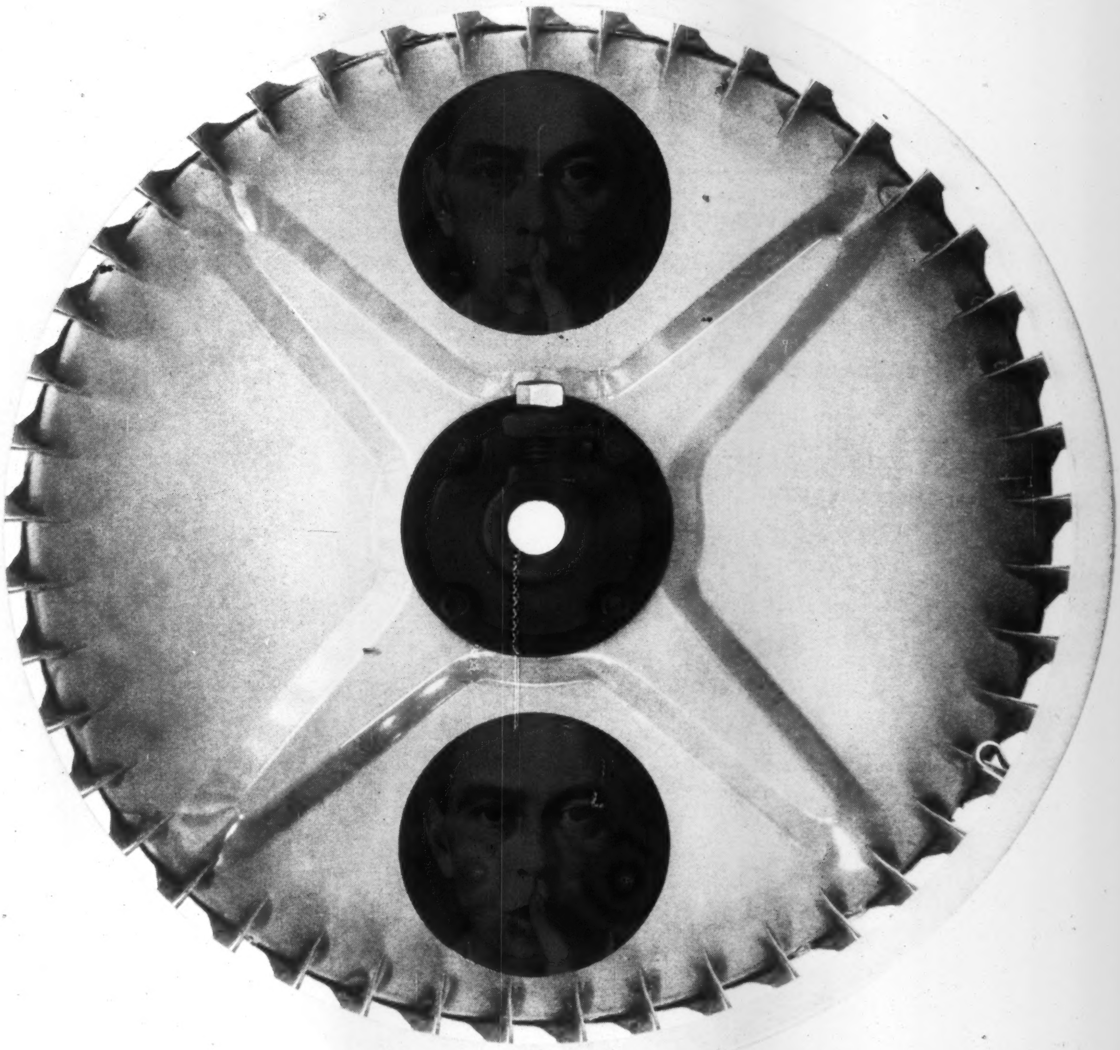
The C7010-A is another fine control in the *complete* line of photocell flame sensing devices manufactured by Honeywell.



For full and complete information, call your local Minneapolis-Honeywell office. Or write direct to Honeywell, Department HA-6-181, Minneapolis 8, Minnesota.

Honeywell

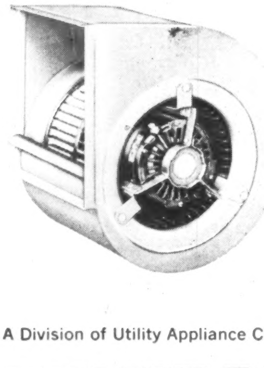
H HONEYWELL *First in Controls*



SILENCE IS THE HUB* OF THE MATTER

*NEOPRENE Noisy fans are fine—at ball games. But here at Utility, we frown on noise in any form, particularly where it concerns our Direct Drive Blowers. And we've done something about it in the form of a new type blower hub that provides quiet operation under all conditions. The material we use in this hub is Neoprene. How do we do it? Well, that's the "secret of silence" of all Utility Direct Drive Blowers. It took time. It took effort. But we think you'll agree that the end justified the means. For due to this Neoprene hub and the extra bonus of silence it delivers, extra sales are showing up on the books of manufacturers of heating, cooling, refrigerating and ventilating equipment. Just another example of Utility's no-nonsense approach to engineering problems that makes it the firm to consult when only the best in blowers and blower parts will do in your equipment.

YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE! Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.



A Division of Utility Appliance Corp.

UTILITY FAN CORP. 911 East 59th Street, Los Angeles 1, California

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Cable: UTILIFAN, Los Angeles

ACCO
for Better Values

R-P&C Valves

DESIGNED FOR DEPENDABILITY

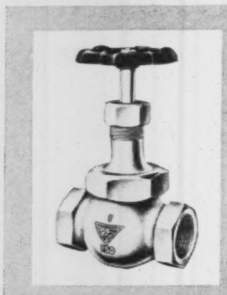


Fig. 1-A, rated for 150 lbs., has special asbestos composition disc for tight shutoff

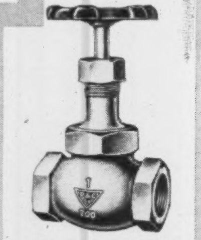


Fig. 409, rated for 200 lbs., has integral high test bronze seat for easy regrinding

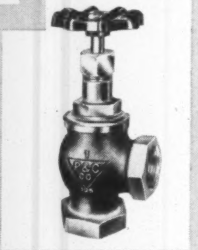


Fig 033 Angle Valve, rated for 125 lbs., has integral seat, re-grinding type disc

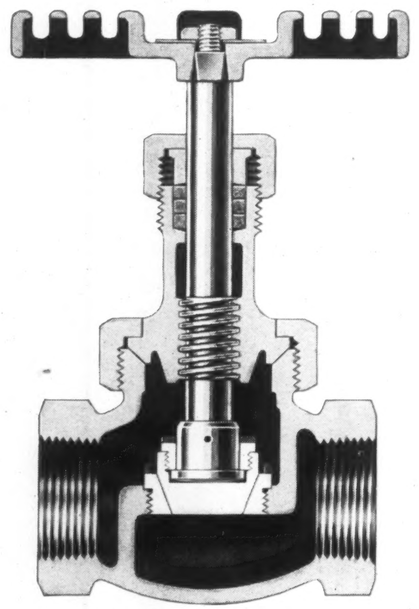


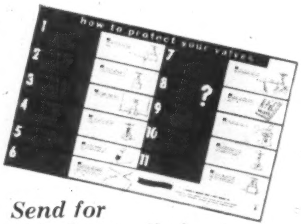
Fig. 427-DP Bronze Globe Valve

R-P&C Distributors offer 9 different models of Bronze Globe Valves—What are your requirements?

• You can select the R-P&C globe or angle valve to meet your particular requirements from a wide variety of seat and disc constructions, with union or screwed bonnet, screwed ends, in pressure classes from 125 to 300 pounds. Your R-P&C distributor offers 9 different bronze globe valves, each in a complete range of sizes—and 8 different models of angle valves which duplicate the construction features found in the globe valve line.

For example, if your application calls for frequent or continuous throttling in steam, water, oil or gas service, the **Fig. 427-DP** shown above is probably your best bet. The full plug construction gives you closer regulation. And the 500 Brinell stainless steel seat and disc resist wire drawing—give you much longer valve life.

Your R-P&C distributor can recommend the specific valve to answer your particular problem. And he has an equally wide selection in R-P&C's complete line of angle, gate and check valves in iron and cast steel, as well as forged steel gate valves. See him today.



Send for this free wall chart
"How to Protect Your Valves"

• 22 in. x 17 in. wall chart tells how to protect valves, get longer valve life—gives installation and operation pointers. Write for your copy.

R-P&C Valve Division
AMERICAN CHAIN & CABLE

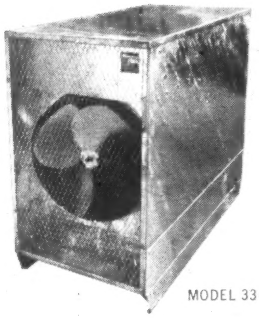
Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit,
Houston, New York, Philadelphia, Pittsburgh, San Francisco,
Bridgeport, Conn.

ACCO
TRADE MARK

Havens

COMPLETE LINE OF PERFORMANCE PROVED COOLING TOWERS FOR EVERY TYPE INSTALLATION

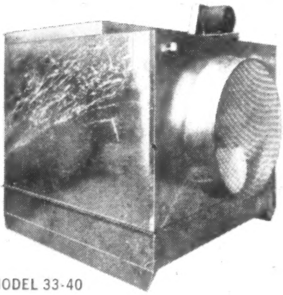
HOT DIPPED GALVANIZED After Fabrication



MODEL 33-7.5

RESIDENTIAL and SMALL COMMERCIAL INSTALLATIONS 3-15 TON

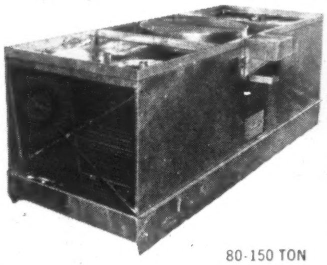
Small and compact, this tower has pan cover, expanded metal inlet screen and expanded metal fan screen. The motor and fan are recessed and hot water enters rear of distribution pan. Slow speed fans insure quiet operation. Easily disassembled if necessary.



MODEL 33-40

LARGE COMMERCIAL AND INDUSTRIAL INSTALLATIONS 20-60 TON

Constructed for easy disassembly, this tower has as standard features a fan screen, belt guard and weather-protected motors. Accessory items at a slight extra cost include a pan cover, expanded metal inlet screen and motor cover.

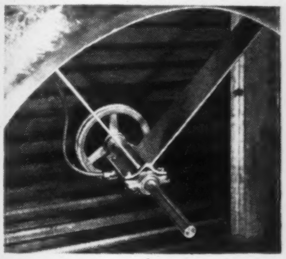


80-150 TON

HEAVY DUTY INDUSTRIAL INSTALLATION HAVENS VERTI FLOW 80-150 TON

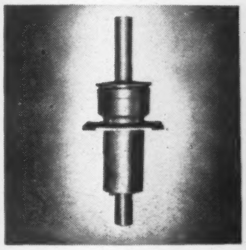
As modern as today's architecture, the low, sleek lines of the Havens Verti Flow Towers blend with building outlines. Fans are all aluminum – variable pitch – and sheaves are corrosion resistant cast iron. Shipped assembled. Also available – 175 and 200 ton Verti Flow models – shipped in 3 sections.

OUTSTANDING PERFORMANCE MINIMUM MAINTENANCE WITH HAVENS LONG LIFE BEARING DESIGNS



33 SERIES BEARING

Porous bronze bearings in zinc-plated cast iron housing. Stainless steel fan shaft. Extra large oil cup.



VERTI FLOW BEARING

Bearing assembly is supported by heavy structural members. All parts are corrosion resistant.

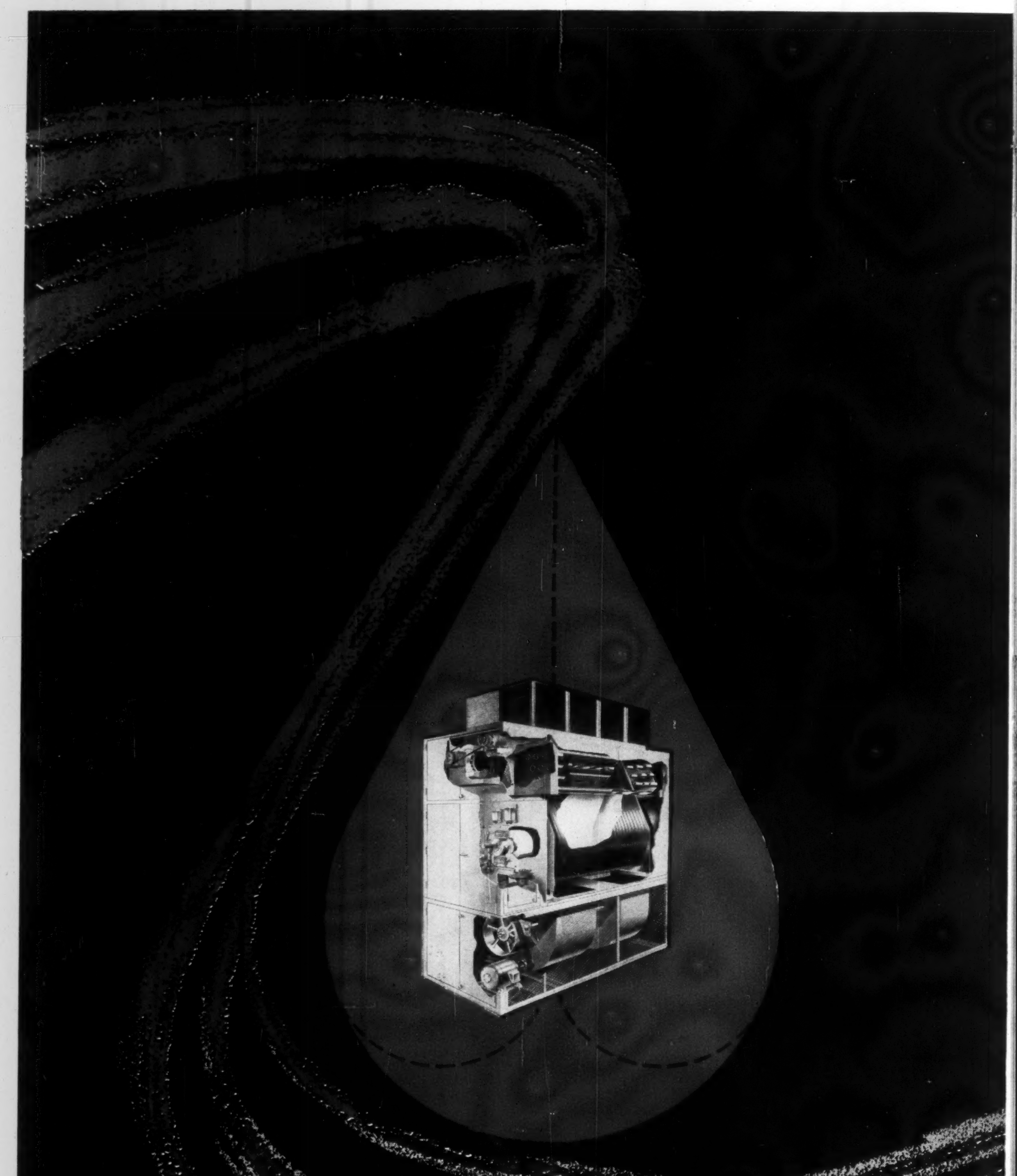
Write for FREE brochures on Havens Series 33 Cooling Towers and Havens Verti Flow Cooling Towers

Havens COOLING TOWERS

Division of

HAVENS STRUCTURAL STEEL COMPANY

1713 CRYSTAL AVENUE • KANSAS CITY 26, MO.



new Dravo heater speeds air flow with

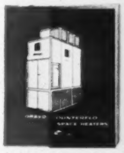
high-efficiency airfoil combustion chamber

Based on aerodynamic principles, the stainless steel combustion chamber of the all-new Dravo *Counterflo* heater is a true airfoil shape. Dravo's research team took two airplane wing sections and placed them back-to-back. The result is a shape that permits maximum air flow with minimum resistance. Every square inch of the chamber is "wiped" by the air stream, and faster, more efficient heat transfer is accomplished. The new Dravo combustion chamber brings you these exclusive features:

- **True airfoil design**
- **Larger sizes ribbed for greater strength . . . channeling of air flow**
- **Stainless steel construction . . . guaranteed for 10 years**
- **Aluminized steel economizer tubes for corrosion resistance . . . guaranteed life**
- **Four-pass flame travel for maximum heat transfer**

The combustion chamber is an important part of the *unitized* design of the all-new Dravo *Counterflo* heater. New induced draft firing, revolutionary PYROJET burner, low-speed fans deliver high velocity airflow through new discharge plenum . . . all combine to make the new Dravo *Counterflo* a remarkably efficient and economical heater.

Write for full information on this remarkable new Dravo heater. There is a size and type for every heater application—for economical space heating—for process drying—for tempering make-up air, as a duct furnace for combination heating, air conditioning and for a host of other applications. Address Dravo Corporation, Pittsburgh 22, Pennsylvania.



Ask for Bulletin 564-16

DRAVO
CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

THE MOTORPUMP
IS ALWAYS A GOOD
sales point

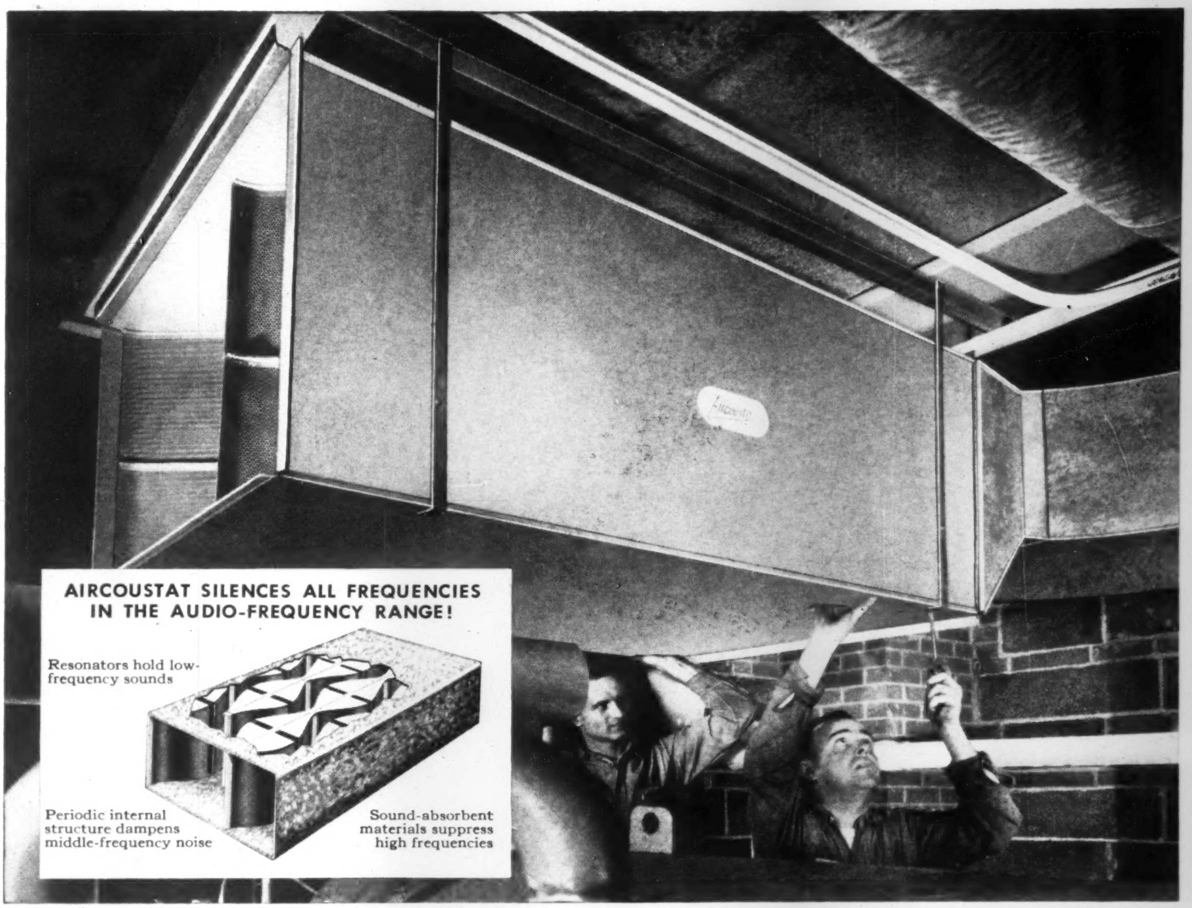
Customers buying air conditioning systems are vitally interested in the various components that make up the system. They want brand names they know and recognize . . .

When you offer Ingersoll-Rand Motorpumps as an integral part of the systems you sell, your customers are getting dependable, trouble-free service from compact pumps designed specifically for air conditioning service. *You* get easy installation, fewer service calls . . . and more satisfied customers.

Motorpumps are available from ¼ to 75 horsepower. Write for our latest literature on Motorpumps for air conditioning service.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

9-595


AIRCOUSTAT SILENCES ALL FREQUENCIES IN THE AUDIO-FREQUENCY RANGE!
Resonators hold low-frequency sounds
Periodic internal structure dampens middle-frequency noise
Sound-absorbent materials suppress high frequencies

AIRCOUSTAT* Sound Traps eliminate air conditioning noise at 50% less cost

Acoustical Performance Guaranteed. Easy to Install. Pre-Engineered — No Design or Layout Headaches.

Revolutionary AIRCOUSTAT Sound Traps require no special tools for installation . . . reduce your labor costs and lower your installation time. Units fit any size or shape of duct. If AIRCOUSTAT fits *geometrically*, it fits *acoustically*.

AIRCOUSTAT is the most efficient method of sound-deadening you can provide your customers. A 7-foot AIRCOUSTAT unit suppresses as much sound as 100 feet of ordinary duct lining. AIRCOUSTAT eliminates all frequencies in the entire audio-frequency range, silences entire systems or selected outlets. Flow resistance and pressure drop are lower. 4 series cover applications ranging from general offices to recording studios.

Discover how AIRCOUSTAT Sound Traps can save you time and money . . . create greater customer satisfaction.

**Koppers Trade Mark*

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with Service

MAIL THIS COUPON TODAY

KOPPERS COMPANY, INC., Metal Products Div., Industrial Sound Control Dept., 6206 Scott St., Baltimore 3, Md.
Gentlemen: Please send me a free copy of your booklet on AIRCOUSTAT Sound Traps.

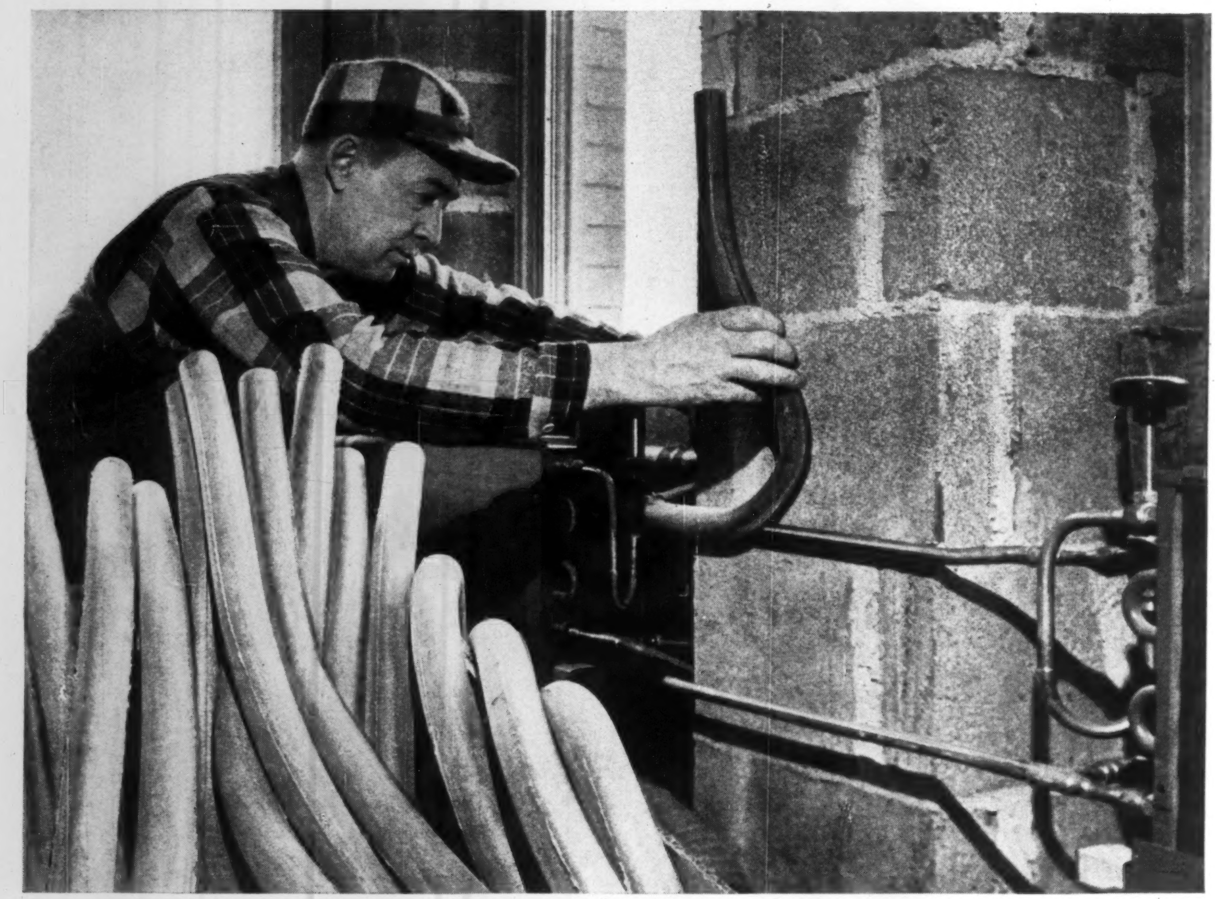
Name.................................... Title....................

Company..

Address..

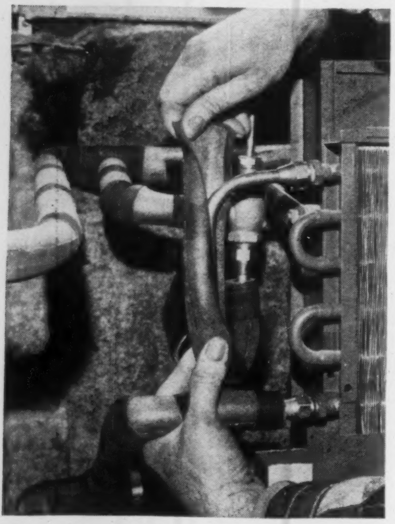
City............................ Zone....... State....................

B.F.Goodrich



Mr. Cabasin of Asbestos Construction Company

Cell-Tite® Insulation does good job on odd job



"To insulate tubing already installed, we required a material that could be applied without pre-forming or complicated fastenings to bends, elbows, Tee-joints and valve seats.

"Our answer was B. F. Goodrich Cell-Tite," said Joe Cabasin of Asbestos Construction Company, insulation contractors on a 31-story office building at 425 Park Avenue, New York.

"We used over 35,000 feet of Cell-Tite to insulate against both hot and cold water condensation and temperature loss in the dual Carrier 'Weathermaster' air conditioning system. And, we got increased ease of application, plus the simplicity and interchangeability we needed for rapid completion. Even with clearances of 2" or less, Cell-Tite gave us complete flexibility.

"With easy-to-install Cell-Tite, a new man fits insulation at the end of his first day, as fast as an old hand. And, in spite of simplicity of application, Cell-Tite supplies the permanence we need.

"Since the insulation had to be applied after the tubing was installed, the pipe coverer has to work in awkward places, reach into hidden areas. With Cell-Tite, all he does is slit it, slip it on, and tape it. Cell-Tite really does the job!"

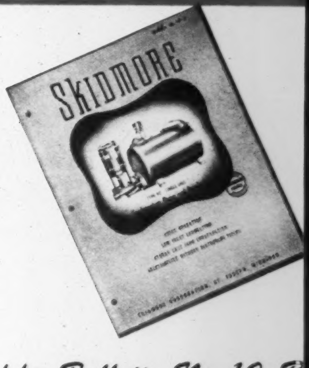
In important buildings all over the world, B. F. Goodrich Cell-Tite is there. Write for your free booklet . . . complete information on Cell-Tite tubing, cord and strip insulation. It's B. F. Goodrich Sponge Products, a division of The B. F. Goodrich Company, **381** Derby Place, Shelton, Connecticut.

B.F.Goodrich

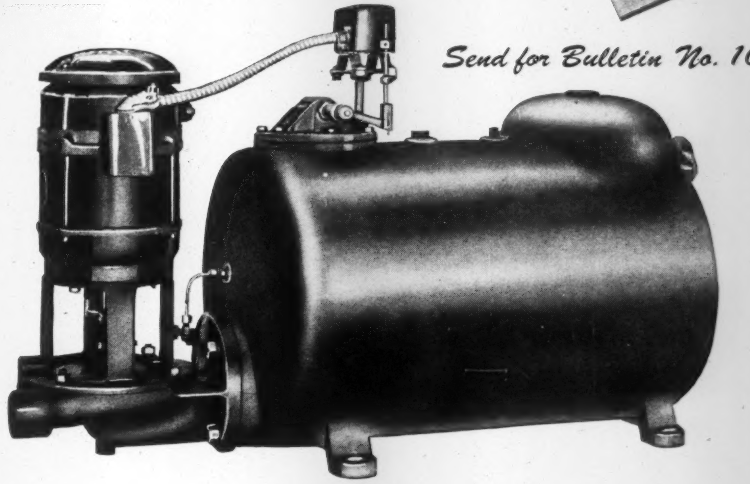
SPONGE PRODUCTS

Skidmore Pumps

Here are the answers to— your Heating Pump Problems



Send for Bulletin No. 10-B



- **Quiet Operation**
- **Low Inlet Connections**
- **Accessibility for Inspection**

TYPE "VC" SINGLE UNIT

Condensation Pump and receiver has low inlet connection . . . operates quietly . . . impeller is bronze centrifugal enclosed type. Especially designed for handling hot condensate, entire unit can be removed for inspection without disturbing piping.

All Skidmore Pumps are furnished in either single or duplex type according to installation requirements.

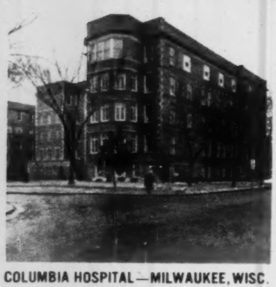
For complete information call or write your nearest Skidmore Pump Representative.

CHOOSE WITH CONFIDENCE

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN

Specify RECO

RECO craftsman attaches copper lining to steel shell of one of the two storage heaters scheduled for duty at Columbia Hospital.



COLUMBIA HOSPITAL—MILWAUKEE, WISC.
Consulting Engineer
Albert H. Myers, Milwaukee
Contractors
A. L. Sauer, Inc., Milwaukee

Operation Hot Water by RECO a success at Columbia Hospital

A hospital never lets up on its hot water demands. And RECO never lets Milwaukee's Columbia Hospital down when a hot water call comes through.

Day and night, two copper-lined RECO Hot Water Storage Heaters pour out over 2,000 gallons of rust-free hot water per hour for a hundred different hospital chores.

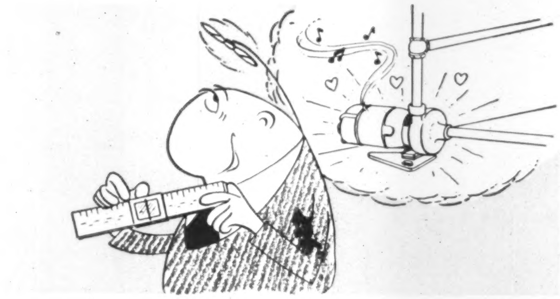
This kind of top performance is standard for RECO heat exchange equipment. That's why the nation's leading consulting engineers specify RECO for important hot water jobs.

Put the RECO guarantee of *top quality and top performance at the right price* into *your* next specifications. SPECIFY RECO!

For free catalogs plus name of nearest RECO representative, write Dept. Q, RECO, 7th & Hospital Sts., Richmond 5, Va.

RICHMOND ENGINEERING CO., INC.

HOW *Cool Carl* the Competent Contractor SOLVED Pump Size Problems



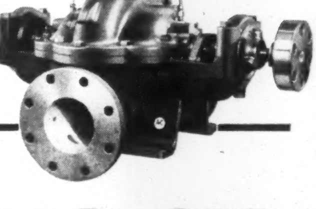
He wanted to supply the *right pump* for each of his many and varied installations.

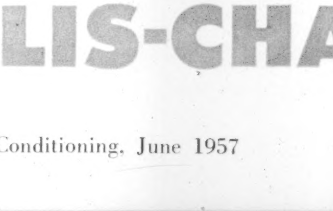
He knew he couldn't afford trial-and-error

He knew he didn't want to deal with a different pump supplier for each application.

Fractional and Integral Horsepower pump line has capacities to 2500 gpm, heads to 400 feet. All close-coupled models have only two base sizes for entire line . . . only two bolts needed to install.

Other Types of Pumps . . . specially designed for air conditioning . . . offer capacities up to 2500 gpm and heads to 550 feet. Even these larger pumps are available for delivery *when you need them.*





He knew Allis-Chalmers Air Conditioning Pumps

Cover 99% of All Pumping Requirements

Capacities up to 2500 gpm
Heads up to 550 feet

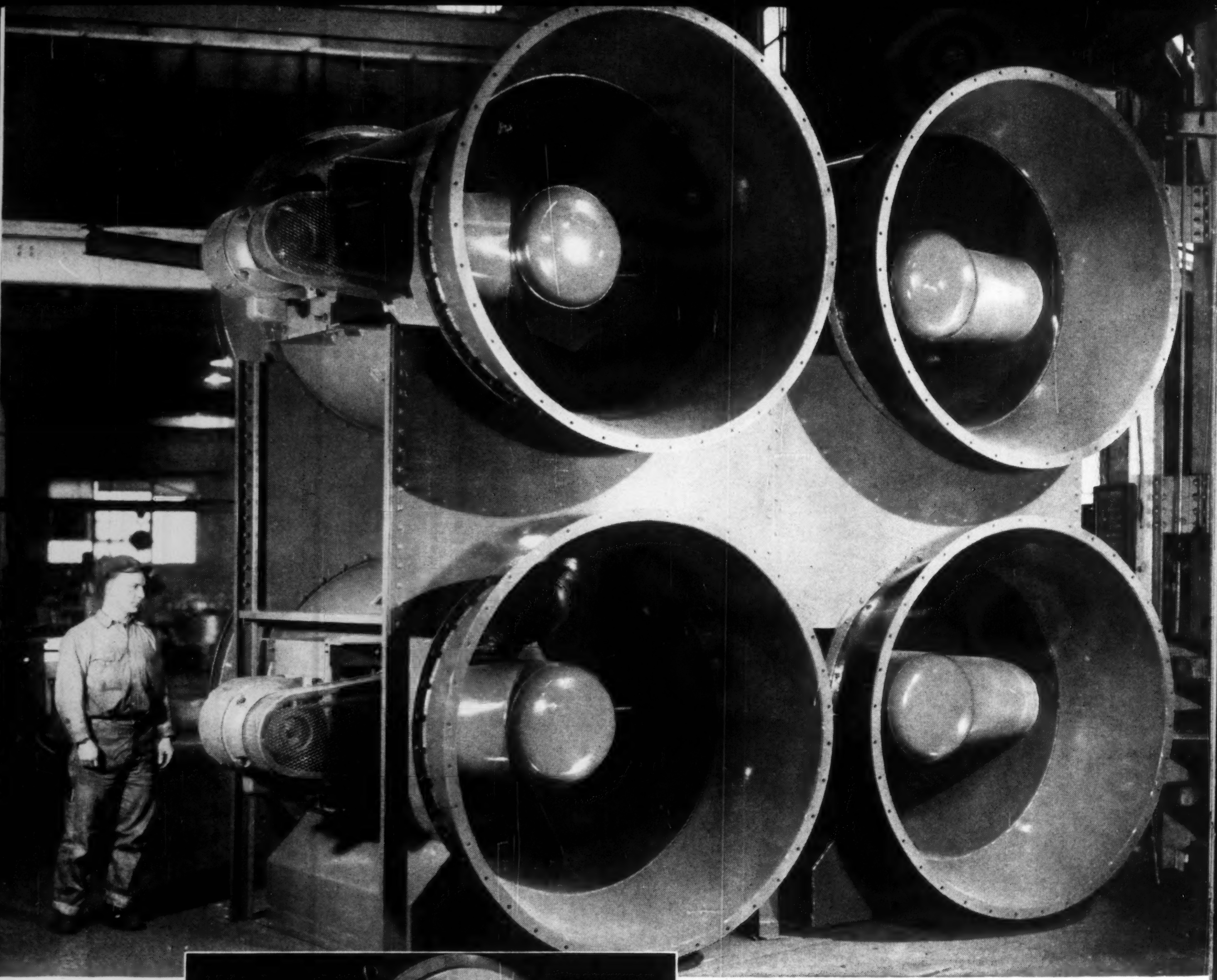
Cool Carl (as usual) chose the most efficient method of solving pump size requirements — by specifying Allis-Chalmers. He found it easy to specify the *right pump* for each of his varied jobs . . . from the complete Allis-Chalmers line.

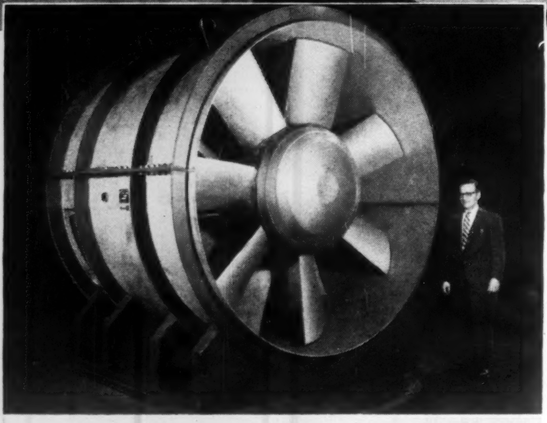
The extra dependability of Allis-Chalmers pumps, supplied with motor and control — designed to work as a unit — reduced Cool Carl's service call-backs — kept his customers happy.

You, too, can save time and money . . . increase your profits . . . by contacting your nearby Allis-Chalmers pump representative or distributor; or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5252





COOLING PACKAGE!
Now cooling a large boiler room to complete satisfaction, these 4 "Buffalo" Axial Flow Fans shown above were made up as a unit "package" for simplified installation. Quiet and highly efficient, they move a lot of air — and remove a lot of excess heat!

210,000 CFM ACID FUME HANDLER!
Giant 96" stainless steel "Buffalo" Axial Flow Fan at right, with cast Aluminum wheel, in a rayon mill in India. One of four in the same mill, ordered over a period of six years.

IN-STACK EXHAUST!
Here at lower right, "Buffalo" Axial Flow Fans mounted right into stacks at a paper mill do a thorough job of exhausting vapors. Duct-size design is a big installation advantage of these fans.

WRITE for Bulletin 3533 to check the performance and installation advantages of these job-proved fans.

WHY "BUFFALO" AXIAL FLOW FANS?

Efficiency and quiet operation — extreme efficiency where duct connections are straight, to take advantage of straight-line axial air flow. Guide vanes in "Buffalo" Vaneaxial Fans eliminate swirling motion of air — convert this energy to forward thrust. Varied pitch of "Buffalo" airfoil wheel means uniform air flow over the blades.

Installation advantages include lighter weight with rugged construction and cylindrical shape. "Buffalo" Axial Flow Fans are simple to install as part of round ductwork — and require less support than centrifugal fans of equivalent capacity. Available direct-connected, or V-belt driven thru streamlined fairing with motor outside of air stream.

BUFFALO FORGE COMPANY, BUFFALO, N. Y.

"Buffalo"

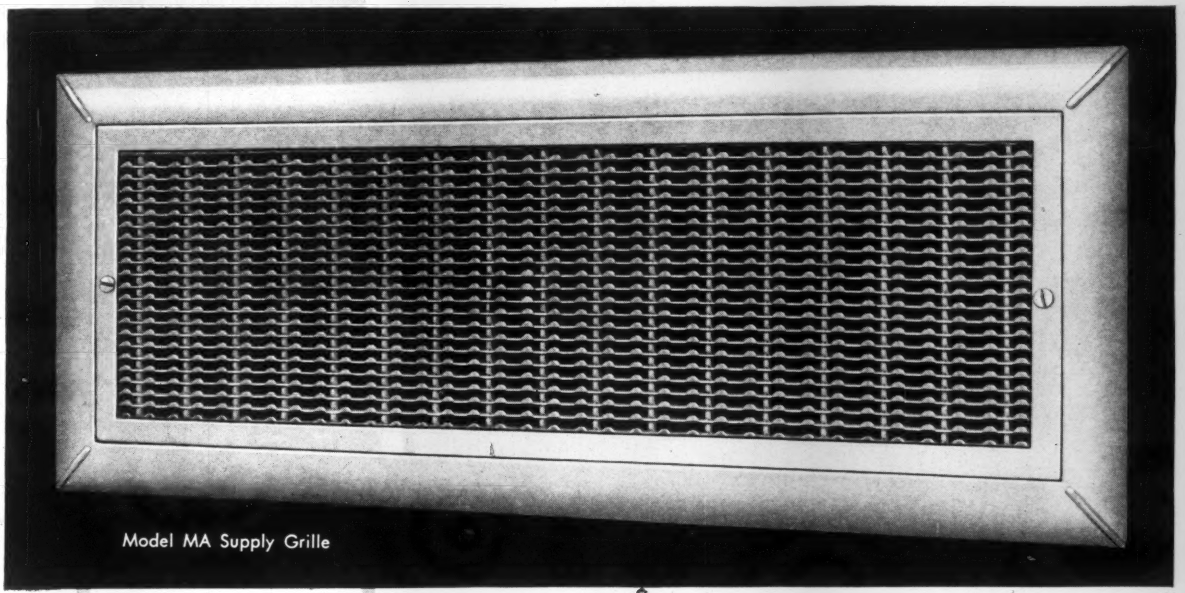
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

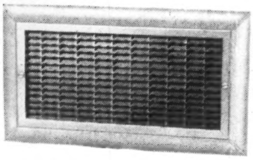
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

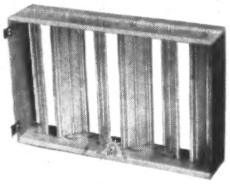
THE MARK OF QUALITY

BARBER COLMAN

Uni-Flo Grilles
make air behave


Model MA Supply Grille


Model MF Return Grilles match the MA Supply Grille, above. A variety of frame styles in a complete line of both supply and return grilles provides continuity of appearance.


Opposed-blade volume control with gang-operated blades provides efficient, nondirectional control of air flow — easy adjustment.

Uni-Flo Grilles coupled with published data from the widely recognized Uni-Flo Laboratory eliminate guesswork. Performance guaranteed when used according to these data. Uniform comfort maintained throughout occupancy space, even with temperature differentials up to 25° F. Air pattern easily adjustable after installation.

Key-operated opposed-blade volume control available for easy system balancing. Key operation resists unauthorized adjustment. Removable, adjustable core and wide variety of frame styles meet various architectural requirements. Tamper-resistant design ideal for use in institutions.

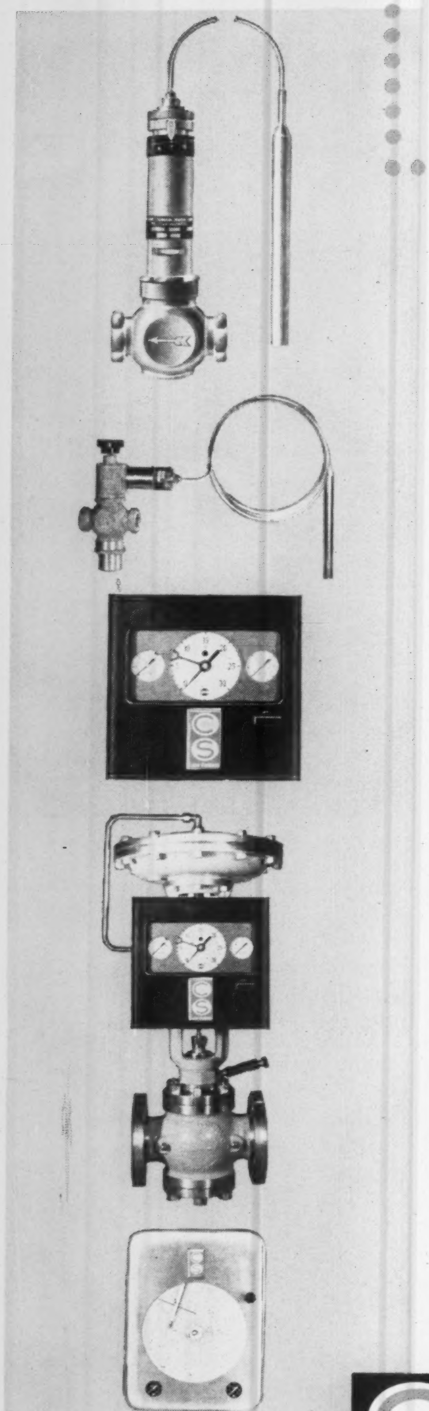
And remember . . . only Barber-Colman combines skills in both air distribution and automatic temperature controls for *undivided* responsibility.

NEW CATALOG — write for new complete grille catalog. Fully illustrated with photos, line drawings, and installation detail drawings. Sample specifications.

BARBER-COLMAN COMPANY

Dept. R, 1101 Rock Street, Rockford, Illinois • Field Offices in principal cities

Air Distribution Products • Small Motors • Automatic Controls • Industrial Instruments • Aircraft Controls • Electrical Components • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery



For Accurate, Reliable Temperature Control

STACON V SERIES

Self Operating Temperature Regulators—

Feature a liquid filled thermal system for high operating power and uniform throttling action and has built-in over-load protection. Available in 50°F. and 100°F. ranges from 25° to 325°F. Direct and reverse acting units ¼" to 1½" with screwed ends, and 2" to 4" with flanged ends. Bulletin No. 500. (Cash Standard Stacon Corp.)

STACON TYPE VS

Temperature Safety Regulators—

Used in the supply steam or gas line and will protect a process by snapping shut when the process temperature goes above a desired temperature level. Easily adjustable and remains closed until manually reset. Available in sizes from ½" to 1½" with screwed ends. (Cash Standard Stacon Corp.)

CASH STANDARD TYPE 51

Indicating Controllers—

An air operated, mercury actuated proportional temperature controller. Temperature ranges from —40°F. to 1000°F. Calibrated set point adjustment, unit construction, air relay with sapphire orifice and push button cleaner, feedback type proportional control with 1-100% band and differential gap. Also available with 1-150% proportional band combined with automatic reset action. Bulletin No. 978. (A. W. Cash Co.)

CASH STANDARD TYPE 30

Diaphragm Control Valve (With Type 51 Mounted)

A rugged, dependable control valve—available in sizes ½" to 12" with various styles of inner valves—reverse or direct acting. Accurate control is assured when the Type 30 is used with 51 or 57 controllers, valve mounted as illustrated, or where the controller is installed remotely. Bulletin No. 980. (A. W. Cash Co.)

CASH STANDARD TYPE 57

Recording Controllers—

An air operated temperature controller with mercury, vapor, gas or organic liquid actuation. Temperature ranges from —350°F. to 1200°F. Available in 9" and 12" case size, spring or electric driven chart drive, on-off control or 1-100% proportional control.

All units have push button nozzle cleaner; proportional controllers also have sapphire jewelled relay orifice with push button cleaner. Bulletin No. 979. (A. W. Cash Co.)

WHAT'S *YOUR* TEMPERATURE CONTROL PROBLEM?

Cash Standard and Stacon have the answer or will find one.

Contact the Cash Standard temperature and pressure control specialist in your area, or write Dept. B.

CASH CS STANDARD

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P. O. Box 551, Decatur, Ill.

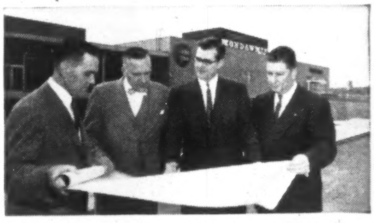
PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS

Architects: Fisher, Nes, Campbell & Associates; Consulting Engineers: Egli and Gompf, Inc.; Structural Engineer: Van Rensselaer P. Sax; General Contractors: Crow-Bart — William L. Crow Construction Co., and Harry Bart; Mechanical Contractors: The Poole and Kent Co.

This is MONDAWMIN

. . . Baltimore's unique 60-store shopping center where you can buy your groceries, take out an insurance policy, or select a bowling ball in air-conditioned comfort!

Air conditioning is an important tool in merchandising — both for customer comfort and for keeping qualified sales personnel, according to Mondawmin Manager Jerome S. McDermott.



Discussing Mondawmin's air conditioning, left to right: A. J. Simpson, American Blower; A. M. Gompf, consulting engineer; J. S. McDermott, Mondawmin manager; E. R. Kent, mechanical contractor.

How do you air-condition 60 stores, each with its own temperature requirements . . . in half the amount of space usually allocated to an air-conditioning system?

Mondawmin, in Baltimore, Maryland — a compact, two-level shopping center designed for convenience — solved the problem with a unique system built around American Blower Multi-Zone air-conditioning units.

In the words of Mechanical Contractor E. Robert Kent: "By letting each compact Multi-Zone air conditioner serve several stores, we were able to make 10 units act as more than 60 individual pieces of equipment. Thus, every store has its own air-conditioning system, thermostatically controlled and automatically meeting its needs for cool, warm, or fresh air. We knew from experience that the American Blower units would give efficient, trouble-free service. And we were particularly impressed with the personal attention American Blower gave us throughout the project."

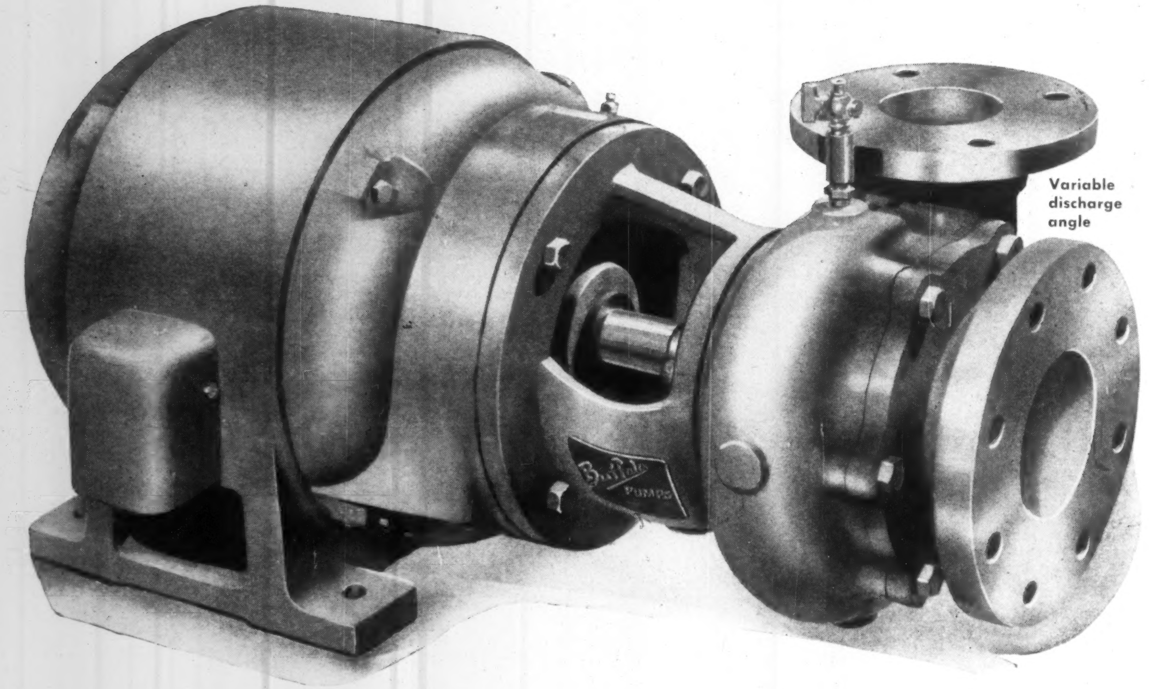
If you plan to air-condition, why not ask your architect or engineer about American Blower equipment; or call our nearest branch office. American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of **American-Standard**

AMERICAN-STANDARD PRODUCTS

AIR-CONDITIONING EQUIPMENT FOR EVERY BUSINESS



Variable discharge angle

Easily mounted, horizontal or vertical

No shaft alignment problem on installation or later

Rugged Solid Shell

Removable side plate

SMALL SIZE – BIG PERFORMANCE –FLEXIBLE INSTALLATION

These husky, compact pumps fit into cramped quarters with ease and deliver big-pump performance with a minumum of installation and service time.

"Buffalo" Close-Coupled Pumps have permanently aligned shafts plus adjustable discharge angle, affording wide flexibility in mounting and piping. And beyond these advantages, they're built for the reliability and efficiency inherent in all "Buffalo" Pumps — with deep, 8-ring stuffing boxes — oversize shafts — sturdy casings with passages offering minimum friction — overall solidity and strength — and the well-known efficient "Buffalo" impellers.

For many clear water services, including chilled water, "Buffalo" Close-Coupled Pumps are the logical choice for yourself and the customer. Write for Bulletin 975-D for a check on sizes, specifications and performance.

"BUFFALO" CLOSE-COUPLED PUMPS FOR CLEAR WATER

1" to 6" sizes 10 to 1100 gpm
Up to 360-ft. head (300 gpm)

"Buffalo" PUMPS

BUFFALO PUMPS

Division of Buffalo Forge Co.
171 Mortimer St. • Buffalo, N. Y.

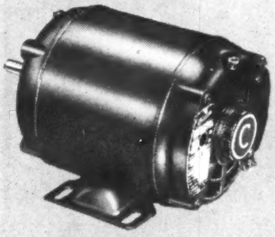
Canada Pumps, Ltd., Kitchener, Ont. *Sales Representatives in all Principal Cities*

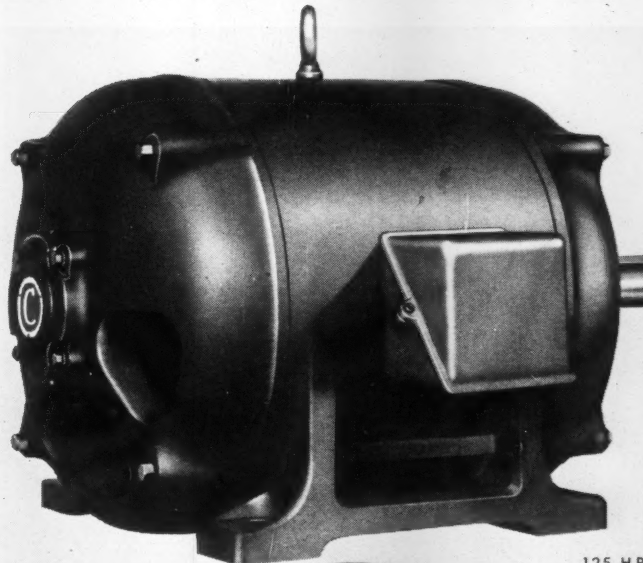
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

CENTURY HAS THE COMPLETE LINE . . .

Big as 400 H.P.

small as 1/20 H. P.





125 H.P. Type SC

WHATEVER YOUR APPLICATION THERE'S A *Century* MOTOR

Performance-Rated© to do the job

You'll get the top performance your equipment's designed for . . . because there's a motor *designed for it* in the Performance-Rated Century line.

Century's technique of Performance-Rating enables you to choose motors with the right size, speed, frame, and torque characteristics to fit—*exactly*—your application requirements.

You can select from a range of 400 to 1/20 h.p.; AC single or polyphase, or DC; drip proof, dust proof, or explosion proof frames. There are optional corrosion-resistant features; constant speed, multispeed, varying or geared speeds.

Let us prove the value of Performance-Rating for you . . . without obligation. Call or write your nearby Century District Sales Office or Authorized Distributor.

***Performance-Rated*© MOTORS 1/20 to 400 H.P.**

CENTURY ELECTRIC COMPANY

1806 Pine Street • St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

The Finest Buildings Deserve The Best—YULA

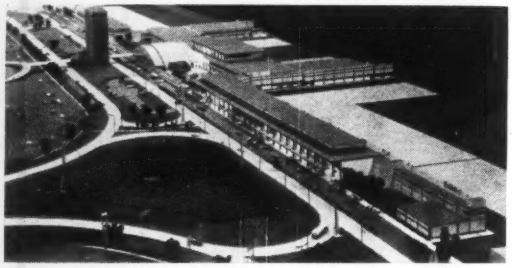
◀ ◀ ◀

The Riverside Church, N.Y.C. Consulting Engineer, Meyer, Strong and Jones, N.Y.C. Mechanical Contractors, Kerby Saunders and Apex Oil Burner Co., N.Y.C.

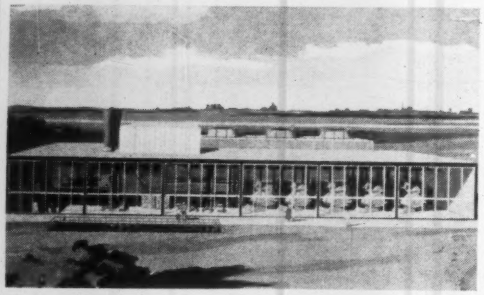
▶ ▶ ▶

Abraham Jacobi Hospital of the Bronx Municipal Hospital Center, Bronx, N. Y. Architects, Pomerance & Breines. Consulting Engineer, Guy B. Panero. Mechanical Contractor, Raisler Corp.

New York International Airport ▶ ▶ ▶ International Arrival & Airline Wing Bldgs. Consulting Architects, Skidmore, Owings & Merrill. Mechanical Contractor, E. J. Brandt.



▼ ▼ ▼ **New York International Airport** Central Heating & Refrigeration Plant — N. Y., N. Y. Architects, Skidmore, Owings & Merrill. Consulting Engineer, Seelye, Stevenson, Value and Knecht. Mechanical Contractor, Almirall & Co., Inc., and Norman Heating Co.



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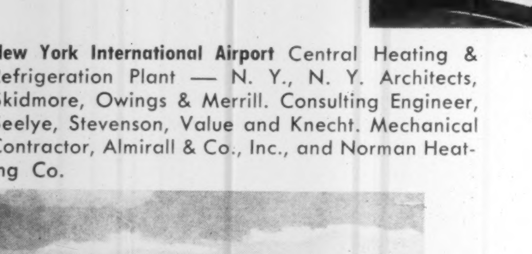
The Seagram Building — N.Y.C. Architects, Mies vander Rohe and Philip Johnson. Asso. Architects, Kahn & Jacobs. Consulting Engineer, Jaros, Baum & Bolles. Mechanical Contractor, Kerby Saunders. Photo courtesy Copper & Brass Research Association

YULA HEAT EXCHANGERS used in these buildings were selected because they are a quality product recognized universally by Architects, Engineers and Contractors.

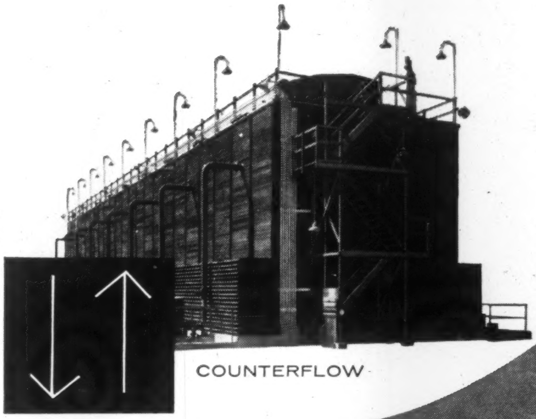
Yula Water Heaters, Inc. 330 Bryant Ave., New York 59, N. Y.



1. Straight-Tube Channel Type Convertor
2. Instantaneous Water Heater
3. Channel Type Interchanger
4. Suction Oil Heater
5. Floating Head Exchanger

Yula

HEAT-TRANSFER EQUIPMENT

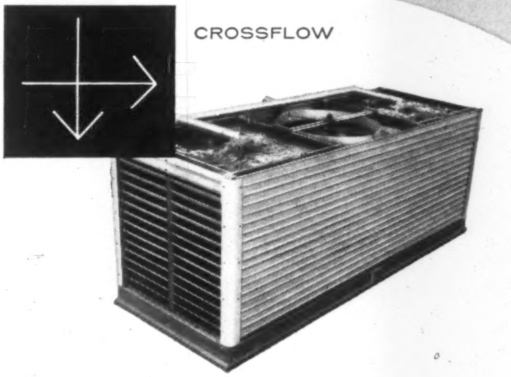


COUNTERFLOW

Pritchard

HEAVY-DUTY COOLING TOWERS

CROSSFLOW



Pritchard

LOLINE®

COOLING TOWERS

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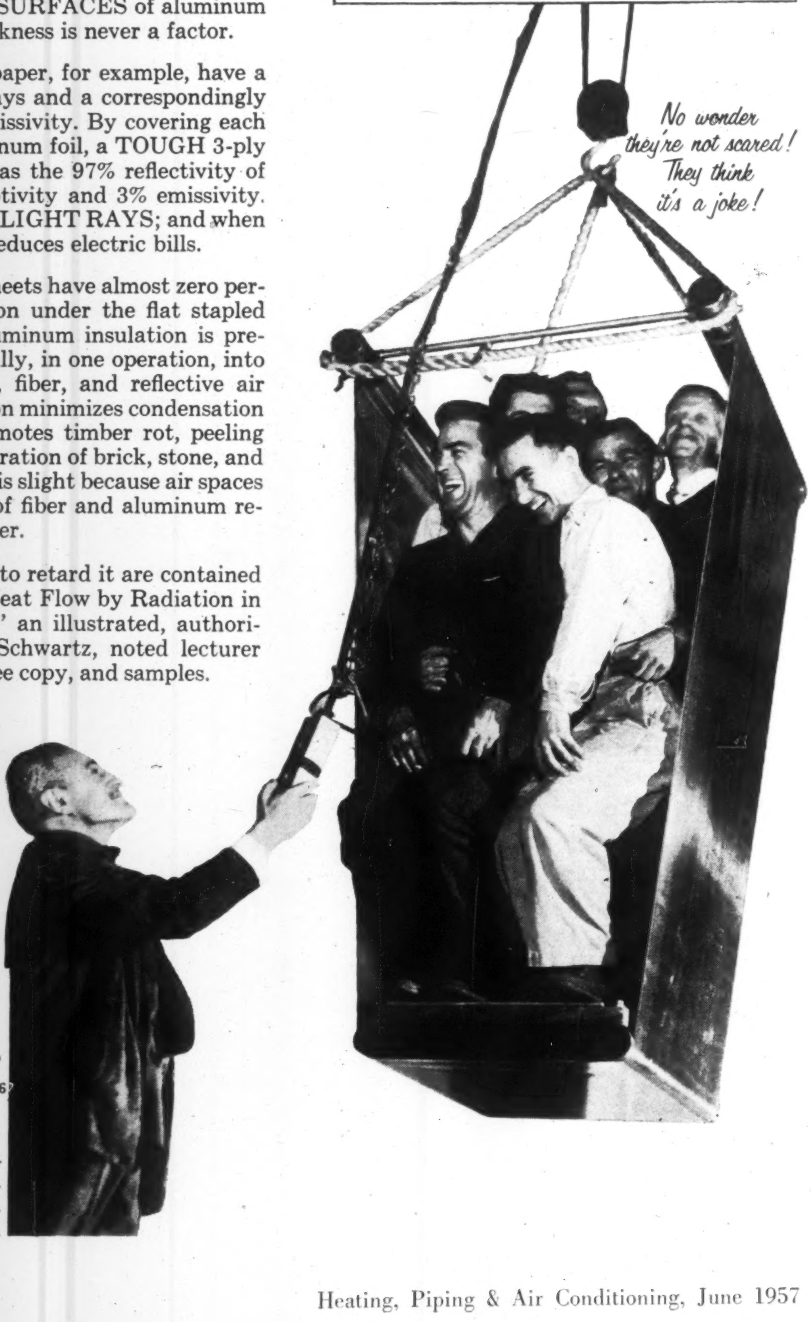
Facts on heat flow and how to retard it are contained in the new 48-page booklet "Heat Flow by Radiation in Buildings, Simplified Physics," an illustrated, authoritative manual by Alexander Schwartz, noted lecturer and writer. Use coupon for a free copy, and samples.



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Cost installed between wood joists, material and labor, about 8¢ sq. ft.

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75 Percent of Offices in N.Y. Now Air Conditioned

. . . 60 percent of the rest are planning for it

Nearly three out of every four New York business offices are air conditioned, a recent survey of the Office Executive Association of New York reveals. Based on a representative 293 companies within the association, the survey shows 201 completely air conditioned, with an additional 16 partly air conditioned.

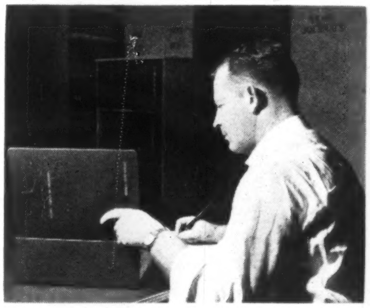
Only 76 reporting companies were without air conditioning. And, of these, almost 60 percent were taking steps toward the purchase and installation of units, 21 percent actually installing units this year or in 1958.

As one alternative to air conditioning, the survey investigated the routine of closing offices early during hot and humid weather. While this phase of the OEA study shows that three out of four offices do not close (the same ratio as air conditioned to non-air conditioned), an interesting point was revealed. Of the offices that do close in uncomfortable summer weather, nearly 10 percent are air conditioned. At the same time, 10 percent of the offices that do not close are without air conditioning.

The usual method of determining conditions for closing is based on a simple formula: if the temperature plus 1/5th of the humidity equals 100 or more, the discomfort level is too high and the office closes early. Where companies use a specific policy for closing, as opposed to a rule of thumb, this formula was mentioned by nearly 63 percent. ╪

Firm's Library Organized for Ready Reference

. . . keeps extensive data up to date, immediately available



"MODERN MAGAZINES are so valuable that someone is always referring to a back copy," says W. F. Hauber, vice president of Thermal Supply. Here a customer consults a back issue of HPAC

Thermal Supply, Houston, Texas, wholesaler of air conditioning and heating equipment and supplies, has gone a long way toward solving the problem of keeping its extensive technical literature files up to date and immediately available, according to W. F. Hauber, vice president.

A library in a separate room adjoining the sales display floor in the downtown location of this distributor serves as a convenient source of information to contractors, engineers, and others. On clearly identified shelves are catalog sheets, specification sheets, product literature, and other essential material.

An experienced librarian spends full time cataloging and replacing material in the library. Indexing has been simplified so that anything required can be found in a hurry.

One section of the library contains engineering handbooks, and instruction manuals. These reference books can be taken from the library for three days.

Another popular section is the back copy file of trade journals. Back copies are kept in binders with the names of the periodicals printed on the covers. As each new issue comes in, the librarian discards the oldest copy and puts the new one in the first position. ╪

Orders for Large Equipment Up 18 Percent

. . . in first two months

Orders for new commercial and industrial heating, ventilating, and air conditioning equipment for the first two months of this year ran 18 percent ahead of new orders during the same period last year, according to the Air Moving and Conditioning Association.

Total shipments for the same period were up 17 percent over a year ago. Leading in sales gains was the centrifugal fan group, which reported 40 percent more orders during January and February 1957 than in the same two months a year ago. With shipments dropping behind new orders, this group also reported a net increase in its backlog of unfilled orders.

Second largest gain was reported by producers of central station air conditioning units. This group reported both sales and shipments as over 25 percent ahead of the same period in 1956.

Power roof ventilator producers reported a slight increase in both shipments and orders over 1956. ╪

Construction Awards Set All Time March Record

. . . 11 percent above March 1956

CONTRACTS for future construction in the U. S. were up sharply in March, as compared with the same month last year, according to F. W. Dodge Corp.

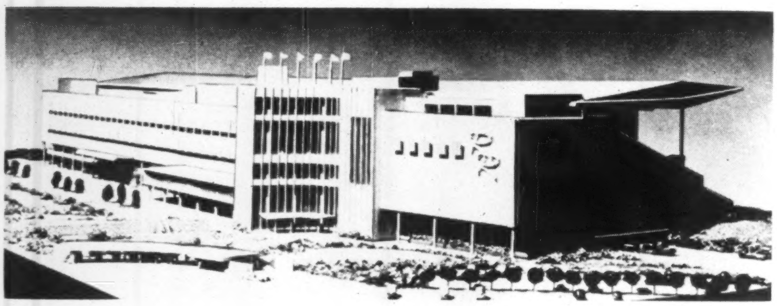
The total of $3,077,997,000 in March was 11 percent ahead of the same month of 1956. This was the largest percentage increase registered in recent months.

Dodge vice chairman Thomas S. Holden reported that "there is no question that the March level of construction contract activity was an all-time March record."

Among a number of large contracts were two office building projects in Manhattan which together totaled over $100 million, a $75 million pipe line development in Texas, and a water supply project in California at almost $50 million.

March contracts for nonresidential building amounted to $1,092,441,000, up 3 percent from last March. Manufacturing buildings and public buildings were far below the year-ago level, but all other major nonresidential types showed substantial increases. Contracts for hospitals were up more than 100 percent above last March.

Cumulative construction contract totals for the first quarter of 1957, with percentage changes from the first quarter of 1956, are as follows: nonresidential, $2,826,647,000, up 9 percent; residential, $2,799,340,000, down 5 percent; heavy engineering, $1,912,573,000, up 14 percent; total construction, $7,538,560,000, up 4 percent. ǂ



650 Ton System Conditions Grandstand

. . . 14 fan systems use steam for heating, chilled water for cooling

THE ROOSEVELT RACEWAY, harness track, at Westbury, L. I., will open its 105 night meet this summer with an air conditioned, glassed in upper grandstand section, first of its kind in the U. S., according to the Johnson Service Co.

This section alone will seat 7500 persons with room for double that number standing. It is part of a $16 million reconstruction job which will bring comfort conditioning to about 250,000 sq ft of space, including the betting areas, club houses, restaurants bars, lounges, and even a fully equipped hospital. All this will be controlled automatically by a pneumatic system that will respond not only to changes in the outside temperature but to the variations in temperature caused by heat from crowds.

The complete installation will have 650 tons of air conditioning capacity. Fourteen central fan systems will utilize steam for heating and chilled water for cooling. A central control panel will allow starting and stopping of remote supply fans and the starting or stopping of exhaust fans in stages. Incorporated are 115 unit heaters equipped with automatic steam valves controlled by dual type room thermostats. ǂ

"Quote"

> **"When a man asks you what time it is, don't tell him how to build a cuckoo clock!"—*George Hall, president of Hyland, Hall & Co., Madison, Wis., and outgoing president of the Mechanical (Heating, Piping & Air Conditioning) Contractors Association of America, citing the advantages of speaking briefly and to the point, in his closing remarks at the 68th annual convention last month in Miami Beach.***

4th Apprentice Contest Set for August 12-16

. . . at Purdue University

THE FOURTH annual international contest for pipe fitting apprentices will be held at Purdue university, Lafayette, Ind., August 12-16, according to Joseph P. Corcoran, director of the training department of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U. S. and Canada.

Participants will be fifth year apprentices who are members of a local union of the UA who are winners of state or provincial fifth year apprentice contests. Only one from any state or province may enter.

First, second, and third place winners will receive $1000, $500, and $250, respectively. ǂ

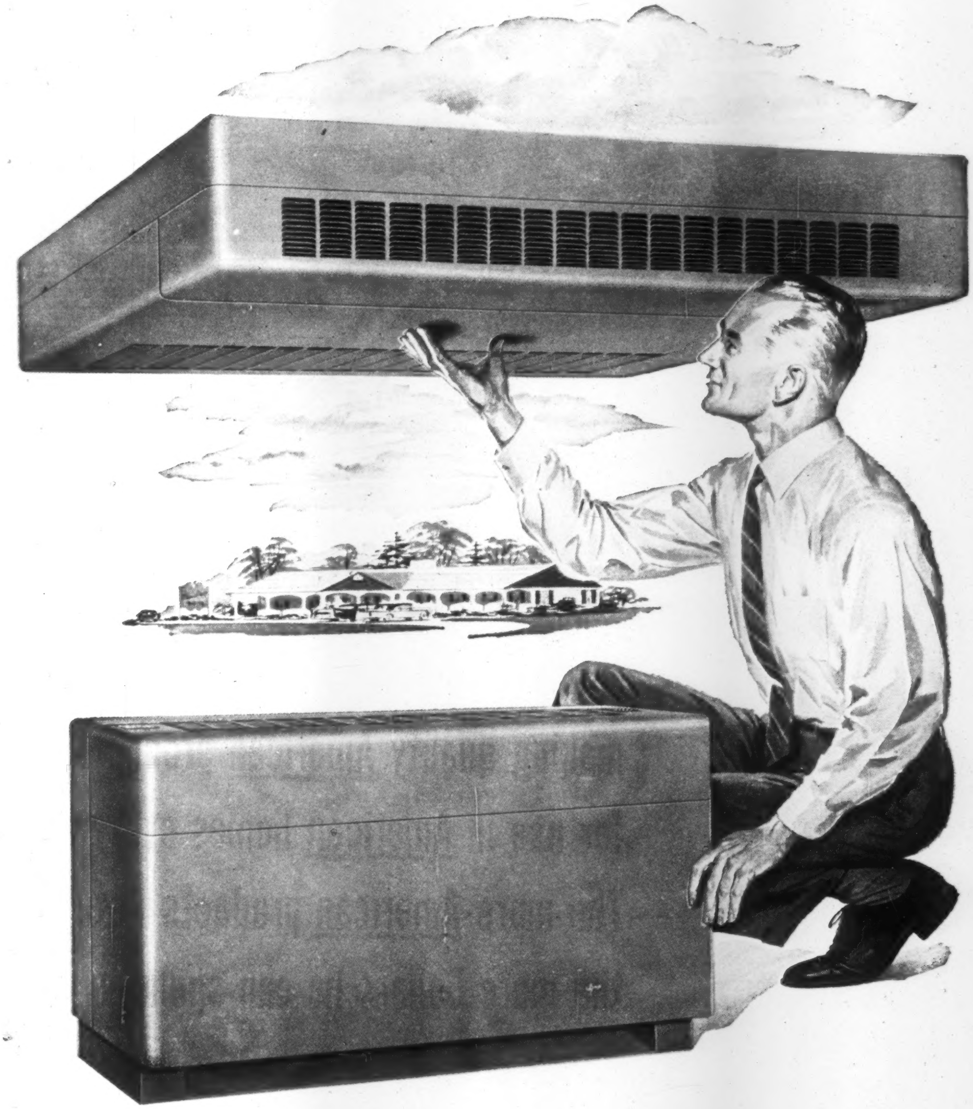
Strengthen Definition of Air Conditioning

. . . add "simultaneously"

THE IMPORTANT word "simultaneously" has been added to the official definition of air conditioning adopted by the American Society of Heating and Air-Conditioning Engineers, according to P. B. Gordon, president.

The new definition recommended by the Society is as follows:

"Air conditioning is the process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space." ǂ



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WARREN WEBSTER

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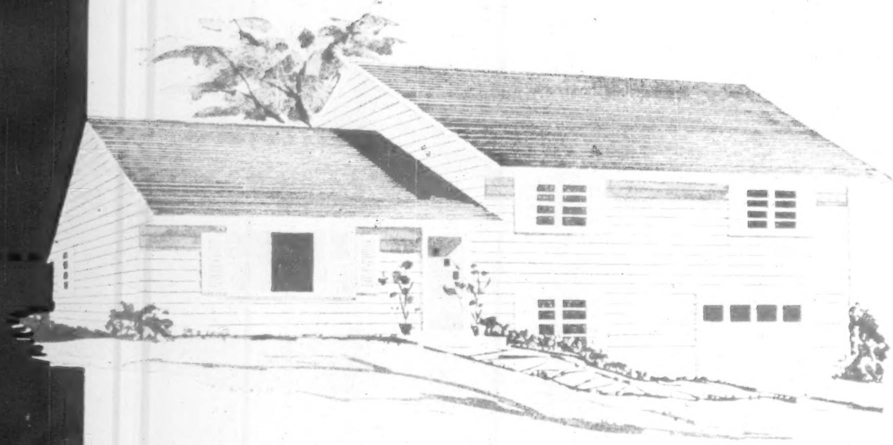

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making quality American products,
for use in American homes everywhere!
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the more Dollars he can spend in America!

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"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

High Velocity Dual Duct Systems Classified Into Three Main Groups

THE ARTICLE *How to Balance High Velocity Air Conditioning Systems*, by William J. Waeldner in the March and May HPAC's, contains an excellent description of balancing procedure and operating difficulties encountered on single duct systems and on dual duct systems of the type described by the author.

However, it should be kept in mind that no general procedure for balancing high velocity dual duct systems could be developed which would be applicable to all types of dual duct installations. At present, the high velocity dual duct systems can be classified into three main groups according to the method of control of volumetric delivery at the terminal points:

1) Systems where static pressures in high pressure ducts are regulated by static pressure regulators installed at critical points in the air handling system.

2) Systems where static pressure controllers regulate cold and warm air temperatures in cold and warm air ducts.

3) Constant volume systems where volume regulation is accomplished automatically in each individual dual duct mixing unit.

The balancing procedures and the operating characteristics of these systems are basically different and should be clearly understood by both the design and the field engineers. For example, the conventional field adjusting of the terminal points with manual dampers is not necessary on constant volume systems, as all units could be set for the required volume at the factory or on the floor prior to the installation. The constant volume systems could be put into operation even on partially completed air handling systems without the necessity of rebalancing the system after completion.

The operating difficulties and the "bugs" encountered in the high velocity dual duct systems can be traced in most cases to the insufficient provisions for volumetric control at the terminal points during partial load operation. The field engineer is helpless to remedy this situation, and it should be considered and corrected in the basic design of the system.

N. S. SHATALOFF
Buensod-Stacey, Inc.
New York

Reviews Air Conditioning of Clothing Factories

IN FURTHER REFERENCE to my comments in the March HPAC on the article *Package Units Provide Worker Comfort* which appeared in the November 1956 HPAC, a brief resume of some of the systems we have designed for clothing factories may be of interest to other readers.

In October 1953, to air condition a new plant of Haggar Slacks at McKinney, Texas, we used two 60 hp reciprocating compressors to furnish refrigerant to a large, direct expansion, built-up coil bank. A large double inlet, double width fan draws air through the coils and distributes it into the space to be conditioned. The equipment is protected by various gages of hardware cloth that picks up lint before the return air enters the ductwork and filters.

In December 1953, we air conditioned the existing large manufacturing plant and home office of Haggar Slacks in Dallas. This system, of 150 tons, consists of two 75 hp compressors; a large, direct expansion, built-up coil bank; a large double inlet, double width fan that distributes air throughout the plant. In this plant the area occupied by the steam irons is extremely large. To create comfortable conditions in this area, we installed a second double inlet, double width fan, on a pedestal, within the conditioned space. This fan takes conditioned air and distributes it through a duct system to provide spot cooling over each of the presses.

Besides the 150 tons already mentioned for this plant, there are 100 tons of capacity provided by selfcontained air conditioning units located throughout the stock area. Because this plant carries stock for all of the firm's subplants, there is an extremely large stock space with a very low occupancy load. It was easily conditioned by selfcontained equipment distributing air through discharge plenums without ductwork. Some piece goods being stored contained formaldehyde as a protective ingredient and dye fixing agent. Because we used a minimum quantity of outside air in this space, the formaldehyde became a problem. To counteract it, we installed ozone generators, which solved the problem.

In April 1955, another Haggar factory, at Corsicana, Texas, was air conditioned. This is approximately half the size of the McKinney plant. Equipment includes one 60 hp reciprocating compressor, with an evaporative condenser and a large factory assembled fan and coil unit. A system of ductwork distributes the air from the unit to the space.

Our firm has also designed three other air conditioning systems for clothing manufacturing plants.

In April 1952 the ladies' wear factory of Justin McCarty, Inc., Dallas, was air conditioned. This system includes a 150 hp reciprocating compressor, using fluorinated hydrocarbon refrigerant No. 12, and a water chiller, supplying chilled water to several fan-coil units suspended from the ceiling of the plant. Conditioned air is distributed horizontally across the plant in the work space. Because the air motion is necessarily higher than what is normally considered good design, the temperature differential maintained is low, to give the desired comfort conditions.

In August 1952 the Marcy Lee Manufacturing Co. plant in Dallas was air conditioned. This is a two story building without a basement. Two 50 hp reciprocating radial compressors are installed in a penthouse on the roof. A cooling tower is adjacent to the penthouse. Direct expansion cooling coils are installed in fan-coil units suspended from the second floor ceiling. The air is distributed horizontally along the ceiling.

The first floor space — mostly stockrooms and warehouse areas — is conditioned by selfcontained units.

In September 1952 the dress manufacturing plant of Munves Fashions, Inc., of Dallas was air conditioned. This system, which serves a single floor of a multistory loft building, consists of self-contained, hermetically sealed units totaling approximately 70 tons of capacity. Horizontal ductwork at the ceilings distributes air to the spaces to be conditioned. A cooling tower is on the roof of the building.

James M. Purdy
Blum and Guerrero
Consulting Engineers
Austin, Texas

Explain Compressor Failure and Use of Air Cooled Condenser Windshields

Regarding the article *How, When, and Where to Use Air Cooled Condensers*, by Warren Viessman, in the September 1956 HPAC, we found some points difficult to understand, particularly the following:

1) The article enumerates several problems, common to both air cooled and evaporative condensers, encountered during winter operation under low outside temperatures. One of these problems is stated as: "Failure to start when the compressor motor is pressure actuated and when the ambient temperature around the condenser is at or below the refrigerated space temperature." Why does the compressor fail to start?

2) In discussing the use of windshields to insure proper air discharge from roof mounted air cooled condensers, the article states that this protection is seldom required, "as the air discharge from the propeller fans is conical with the fan axis and not axial. Therefore, discharges are not seriously affected, even when opposed by direct head winds of 10 or 15 mph or more." Can this be explained a little further? Also, is such protection required in the case of a centrifugal fan?

J. Matsumoto
Hitachi, Ltd.
Tokyo

The author's reply — 1) Where compressor operation is controlled by a low pressure switch only, and the air entering the air cooled condenser is below the temperature of the refrigerated space, the suction pressure may not rise sufficiently during the off-cycle to activate the low pressure switch. The result is that the compressor will not start even though the refrigerator or conditioned space requires cooling.

2) The air discharge from the propeller fan is conical about the fan axis. It consists of an axial component and a centrifugal component. Its force is therefore not directly opposed to winds facing the fan, but is at an angle or conical to it. Moderate counterflow winds, in practice, therefore have little effect on the propeller fan unit output. A centrifugal fan or duct discharge system should have a shield for exposed locations, as these would be directly affected by opposing winds.

Warren Viessman
Chief, Mechanical Branch
Installations Directorate
Hq Air Research & Development Command
Washington, D.C.

Justifies Electrical Tracing for Pipe Line As Important Piece of Equipment

In his comment in the August 1956 HPAC on my answer to the Question of the Month, *Which Should You Use — Steam or Electrical Tracing for Pipe Lines?*, in the May 1956 HPAC, Ralph H. Cushing suggests the need for more cost data on insulation.

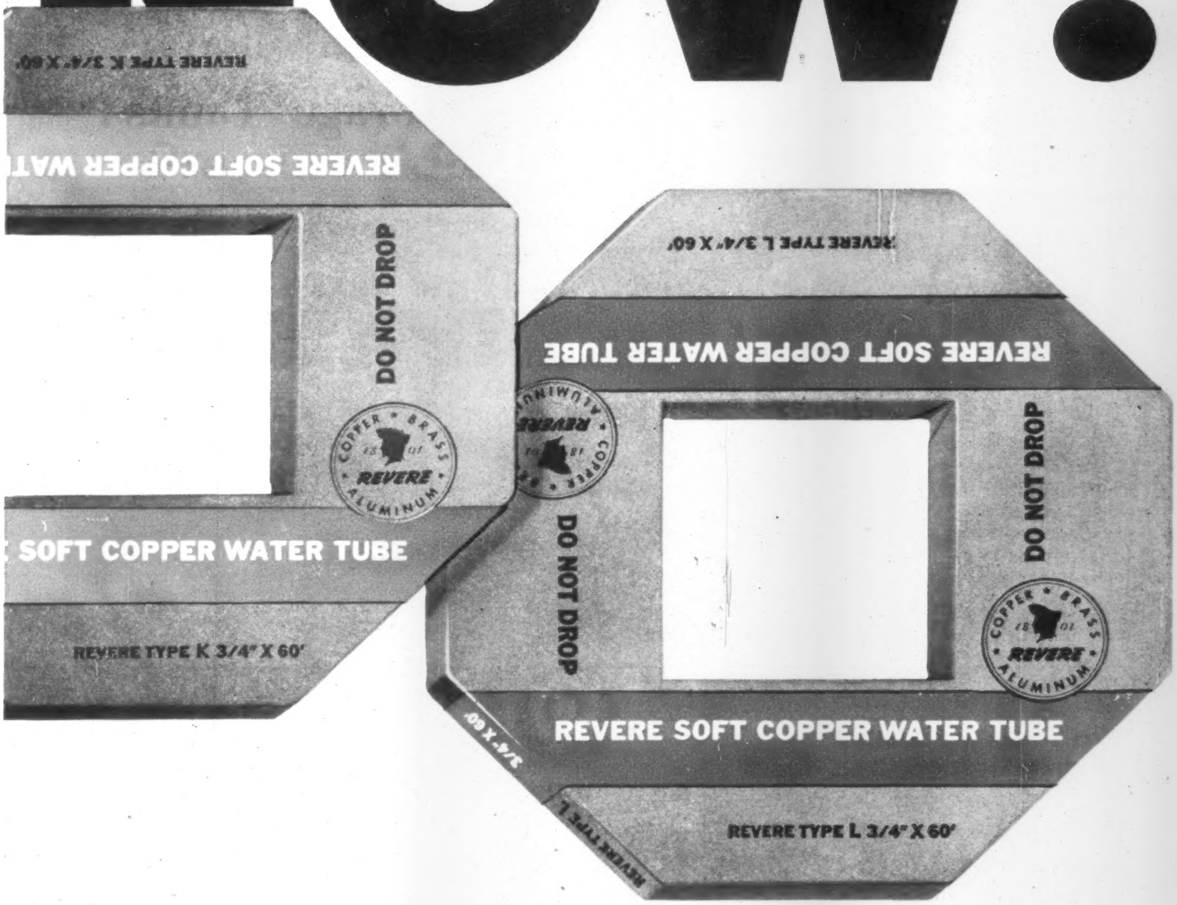
I feel there are others who could deal with these phases of pipe line construction better than I.

Regarding Mr. Cushing's fear of the cost of electrical tracing with a heater inside a 2 in. steel pipe, while it would cost more than a small lead covered cable wrapped around the pipe, many large companies are finding that a considerable investment is justified for large and important pipe lines.

No doubt there are many places for laboratory use and for short, small overground lines where some quick easy way is ample. However, for major installations, especially those that are buried, it is hard to justify saving on first cost when any repair would mean digging up the line and removing all the waterproof insulation to get at a small spiral wrapping of the tracer.

Lee P. Hynes
Consulting Engineer
Haddonfield, N. J.

NOW!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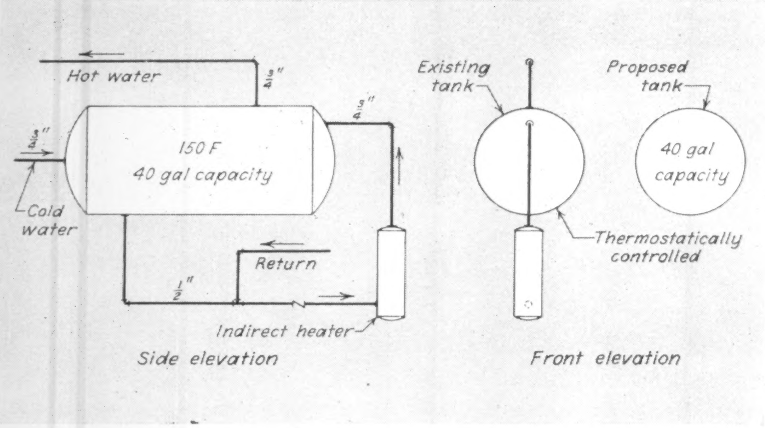
Question of the Month

How Should Piping Be Connected Between Two Hot Water Storage Tanks?

THIS QUESTION *was asked previously in HPAC and is repeated here along with some of the answers that have been received from readers. Other answers or comments for publication are invited.*

"How should I connect an existing indirect fired hot water storage tank to another tank to double the capacity, using the same heater. How can I be sure that both tanks will be filled with hot water before the thermostat shuts down the heater? The maximum water flow rate will be 3 gpm, and the usage will be intermittent. —T.E.S.


Hot water
3/4"
3/4"
3/4"
150 F
40 gal capacity
Cold water
Return
1/2"
Indirect heater
Side elevation
Existing tank
Proposed tank
40 gal capacity
Thermostatically controlled
Front elevation

Connect Tanks in Parallel To Equalize Storage

WE HAVE USED the method shown in Fig. 1 satisfactorily in larger hookups, and our experience has proven that by connecting the tanks in parallel as shown the equalization of storage can be successfully obtained. When starting up this system, the manual flow control valves can be adjusted to feed each tank equally so that the thermostat placed in one tank will operate the system automatically.

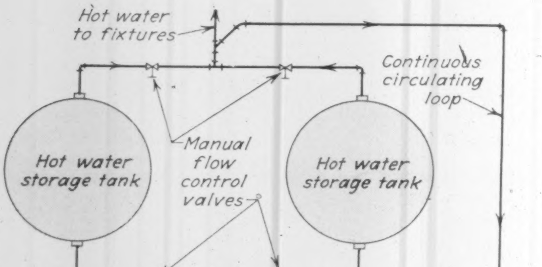

Hot water to fixtures
Continuous circulating loop
Manual flow control valves
Hot water storage tank
Hot water storage tank
Circulating pump
Check valve
Return circulation
Indirect heater
Check valve
Cold water inlet

Fig. 1

The return circulation from the building and the continuous circulation by circulator or pump will mix with the makeup cold water, thus reducing the chill and shock from the indirect heater and tend toward a more even demand for steam, hot water, or whatever other heating medium is employed.

We assume that the indirect heater is capable of handling the increased demand that is indicated by the necessity of installing an additional storage tank.

JAMES J. COLEMAN
Chief Engineer
Laundry and Textile Div.
The Patterson-Kelley Co., Inc.
East Stroudsburg, Pa.

Provide Controls to Allow Withdrawing Water in a Stepwise Manner

REQUIRED tank volume for hot water storage is usually calculated as a percentage of an hour's average load. Typical values range between 35 and 60 percent, depending upon type of service. Since this information has not been given, a factor of 50 percent will be assumed. For 3 gpm maximum flow rate, a storage vol-

(Continued on page 96)

new

A.S.M.E. *RATED*

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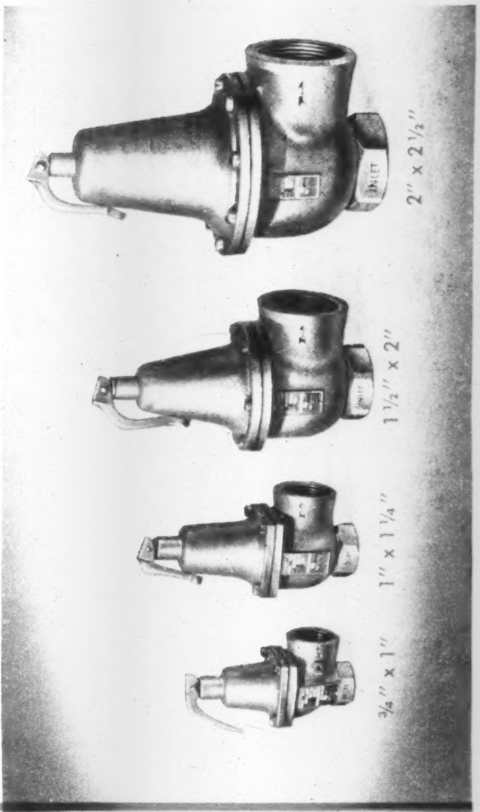
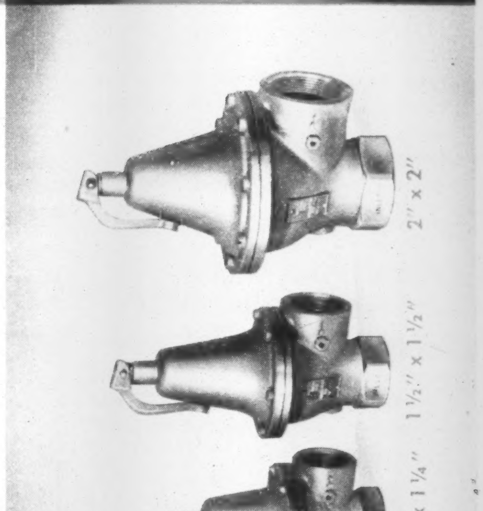


No. 74A-740 Series — EXPANDED OUTLETS
These valves have large internal flow areas and increased outlets to afford individual relief valves with exceptionally high BTU/HR steam discharge capacity ratings. They are especially designed and rated for hot water *space heating boilers*.



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174A Series afford complete pressure protection for the great majority of all hot water *heating* and *supply* boilers with a single valve. The completeness of 174A Series, No. 74A, and 740 Series line makes it possible for you to meet the smallest or largest requirements for pressure protection from one line of valves.

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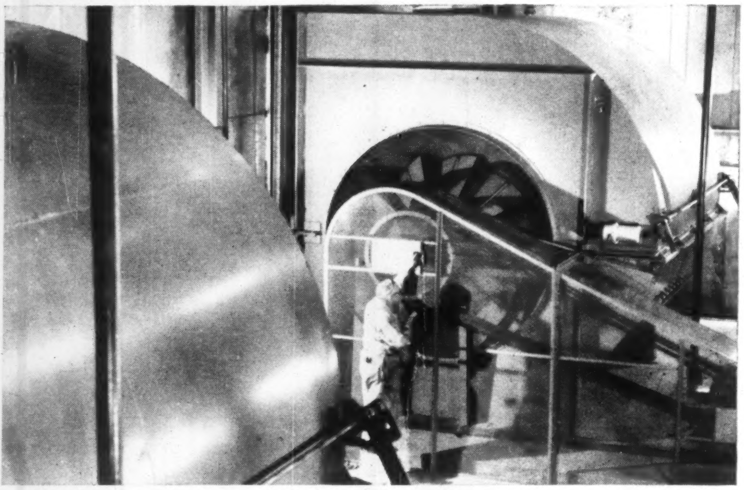


Two huge Chicago Blower centrifugal airfoil fans handle 375,000 c.f.m. of air in supplying cool, conditioned air throughout the newspaper plant and office areas. Special "Chicago" aerodynamic fan blade design keeps noise level at an absolute minimum.

AIR CONDITIONING MILESTONE

DES MOINES—The combination 13- and 4-story Register-Tribune building is the only large newspaper publishing plant to be successfully air conditioned throughout from a single air handling unit.

WIDE TEMPERATURE RANGE

In addition to fitting duct work into an almost impossible structural situation, the engineer was faced with widely varying room temperatures that result from the amazing variety of operations performed in a newspaper plant. Under one roof and in close proximity are hot stereoptyping operations, typesetting, darkroom facilities, wire service functions as well as office areas where humans work feverishly to satisfy the news demands of ever-humming, ever-hungry printing presses.

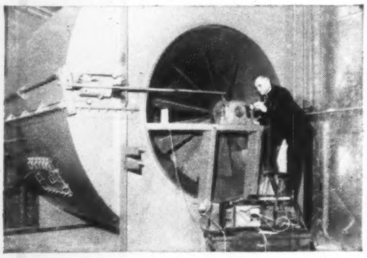
CHICAGO BLOWERS CIRCULATE 375,000 C.F.M. OF AIR THROUGH 1½ MILLION CUBIC FT. AREA

"One of the toughest problems," according to Mr. Wm. E. Nanes, consulting engineer, "was the cool air circulating fans."

"The Register-Tribune people specifically requested the quietest fans available. It turned out that Chicago Blower Corporation could meet our needs on both counts. They had the capacity we wanted and their special hollow-sectioned air foil blade construction made the fans surprisingly quiet."

92% EFFICIENCY WITH LESS POWER

Two Chicago Blower fans, whose housings are 15′ high, were used. Each fan rotor is over 7′ in diameter and weighs 3000 pounds. Because the blades are aerodynamically designed, similar to an airplane wing, eddy currents responsible for turbulence and noise are virtually eliminated. Fan efficiencies are an amazing 92% and they operate on less power. Noise level over similar capacity units is reduced as much as 40%.



Chicago Blower makes it standard procedure to give all large blower installations a final field balancing.

CHICAGO BLOWER ENGINEERING ASSISTANCE ALWAYS AVAILABLE

Chicago Blower plant and field engineers are always on call to assist firms working on heating and ventilating problems. They bring to any job a wealth of time-, trouble-, and money-saving information gained on thousands of installations.

7207

CHICAGO

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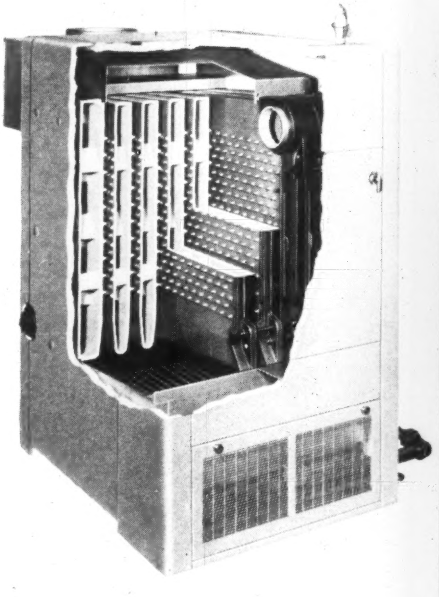
Your local
Chicago Field
Engineer is in the
'Yellow Pages'

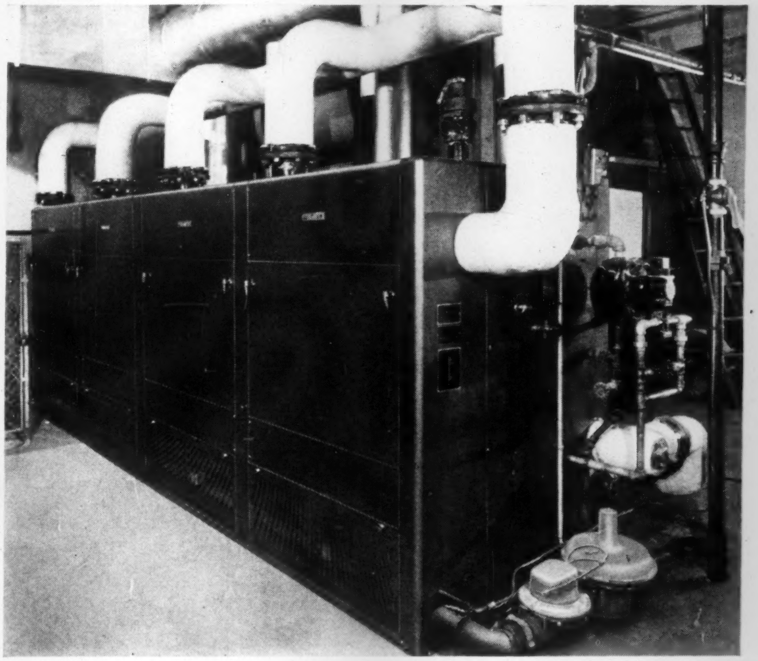
Want all the facts about this aerodynamically-designed fan? Ask your "Chicago" field engineer for a copy of Bulletin A-103. You will find him listed under "Fans," "Blowers," or "Ventilating Equipment and Supplies" in the YELLOW PAGES of your phone book. If you prefer, write or call direct and complete information and service will be provided.

You'll find what you're looking for in the

WEIL-McLAIN TYPE "J"

GAS FIRED CAST IRON BOILER





Barnett Detroit Cartage Co., Detroit, Michigan is heated with a Weil-McLain J-37-S Boiler with a capacity of 4,500,000 AGA input BTU/hr. The contractor says: "The ease of installation of such a big boiler was amazing to myself and the men. The pick-up and efficiency of this boiler is another good feature."

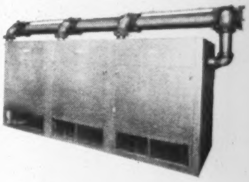
Heating Contractor: Regal Plumbing & Heating Co., Inkster, Michigan
Distributor: Warren Plumbing Supply Co., Detroit, Michigan

Fuel economy will certainly be high in your list of qualifications. That's why you are urged to critically compare the design of burning equipment and heat absorbing surfaces in the Weil-McLain Type J Boiler. Ribbon burners are carefully engineered to develop exceptional gas burning efficiency and the unique construction of the sections effectively soaks up heat.

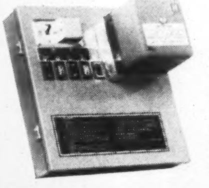
The Type J Boiler is *cast iron*—strongly resistant to the corrosive effects of gas firing. It is sectional in construction—easy to erect in minimum space—easy to enlarge if added capacity is ever needed. The horizontal draft divertor materially reduces necessary head room.

NEW FEATURES

EASY-FIT HEADER



Assures correct header piping for proper steam development and release. Equipped with Dresser compression fittings—offers all the advantages of a swing header without the added erection costs. Easy-Fit Headers are machined and pre-fitted at the factory and shipped partially assembled, with all parts clearly marked for easy erection on the job. Write today for engineering data.



ELECTRONIC CONTROL PANEL

This complete gas boiler control panel reduces electrical work to a minimum. With its compact grouping of identified components, visual indication of operation and easily understood operating instructions, this electronic control assures lower installation cost as well as correct operation of the boiler.

WEIL-McLAIN
BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-67

(*Continued from page 92*)

ume of 90 gal is required, which is 12½ percent greater than that of the proposed installation. However, since the 3 gpm rate is maximum, it is probable that two 40 gal units are adequate.

When employing two or more tanks for hot water storage, it is recommended that controls be provided to allow withdrawing water in a stepwise manner. This arrangement permits emptying one vessel to approximately 25 percent of its normal volume, at which time the controls permit taking hot water from the second tank.

One type of arrangement that may be employed for this service is shown in Fig. 2. Control valves A and A′ remain closed until the storage tanks are full of water. The float positions the valve between selected limits. When full tank volume is obtained (40 gal), the valves open, allowing discharge of hot water to the system load. Required water temperature is obtained by setting heating steam control valve *B* to keep water temperature leaving the indirect heater at a value greater than the tank water temperature. This valve modulates steam flow to obtain the set temperature, regardless of water flow rate.

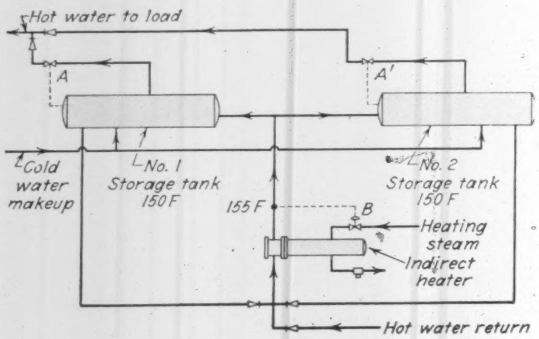

Hot water to load
A
A′
Cold water makeup
No. 1 Storage tank 150 F
No. 2 Storage tank 150 F
155 F
B
Heating steam
Indirect heater
Hot water return

Fig. 2

H. B. Wayne
Consulting Engineer
Woodhaven, N. Y.

Cross Connect Pipe Lines So Both Tanks Function as One Unit

I suggest that T.E.S. connect the two hot water storage tanks so that the two tanks will function as one unit, as shown in Fig. 3. Connect the cold water into both tanks so that it can flow into either or both tanks.

Cross connect the circulating lines from the bottom of the two storage tanks so that the water from both tanks can flow by gravity into the indirect fired heater. Tie the hot water line from the heater to a header that ties into both storage tanks near the top and at the end opposite to where the cold water enters the tanks.

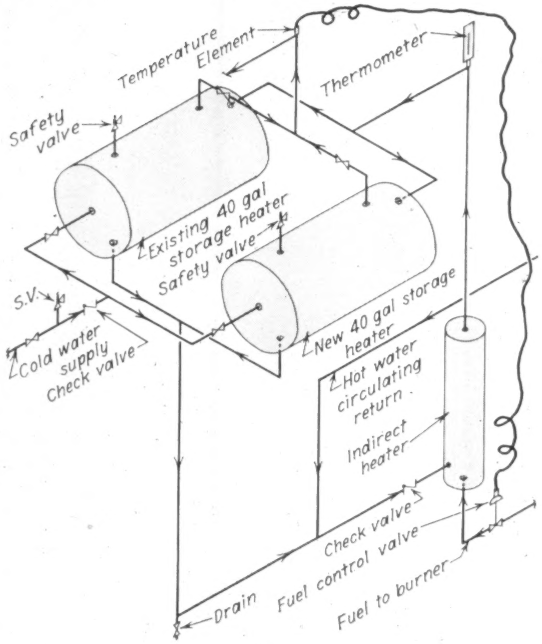

Temperature Element
Thermometer
Safety valve
Existing 40 gal storage heater
Safety valve
S.V.
Cold water supply
Check valve
New 40 gal storage heater
Hot water circulating return
Indirect heater
Check valve
Fuel control valve
Fuel to burner
Drain

Fig. 3

Cross connect the hot water outlets from the two storage tanks. From this cross connection take off the hot water supply line to the fixtures. Locate the temperature bulb, of the valve in the fuel line to the fired heater, in the hot water supply line to the fixtures. The set temperature of this bulb should be a little higher than if it were mounted in the tank. When the water gets up to temperature the temperature bulb will cause the valve in the fuel line to close, but should allow the pilot to continue burning all the time. The storage tanks should be provided with safety relief valves and if the cold water is from a high pressure line it should be protected by a water pressure relief valve.

Sheldon R. Higgins
Mechanical Engineer
Long Beach, Calif.

READER ASKS—

"How to Connect Radiators in Reverse Return System?"

"We have installed a two pipe reverse return hot water heating system which is giving us trouble.

"The mains are 12 ft overhead which supply the radiators at the top. The water is returned from the radiators through risers connecting the bottom of the radiators and the return line. The bottom of the radiators are cold even though this is a forced circulation system.

"How should the radiators be connected to prevent the short-circuiting?"—C.J.H.

• *YOU ARE INVITED to answer this question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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HOT WATER
STORAGE HEATERS
contents
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With the increasing trend to copper-lined water heaters for rust-free water and low maintenance, P-K has compiled for you complete data on this type of heater. Complete specification outline, construction details, heating capacities, engineering and installation data, plus many other needed facts are all contained in this compact, concise, easy-to-use file. A copy is yours for the asking. . . . Mail the coupon today. The Patterson-Kelley Co., Inc., 116 Burson Street, East Stroudsburg, Pa.

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Freon Chillers and Condensers

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East Stroudsburg, Pa.

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THIS NEW **VACUUM HEATING PUMP**

HAS THE INCREASED AIR CAPACITY
EFFICIENT HEATING PRACTICE DEMANDS

It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ Increased air capacity induces rapid system response without wasteful overheating.
- ✓ Separate air and water pumps individually selected to meet actual job requirements.
- ✓ Control system that operates individual pumps only when needed.
- ✓ Flexibility permitting addition of radiation without changing basic pump installation.
- ✓ Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

Large sheet metal penthouse — containing all equipment and most ductwork — helps solve problems as . . .

Single Large Air Handling Unit Conditions Newspaper Plant

BY WILLIAM E. NANES
William E. Nanes Engineering Co.
Consulting Engineers

THE LARGEST air conditioning installation in Iowa serves the 13 and 4 story Register and Tribune building in Des Moines. A 1000 ton capacity, medium pressure, medium velocity dual duct system provides conditioned air 22 hours a day.

The two-section building is the only large newspaper publishing plant in the U. S. to be air conditioned from a single air handling unit.

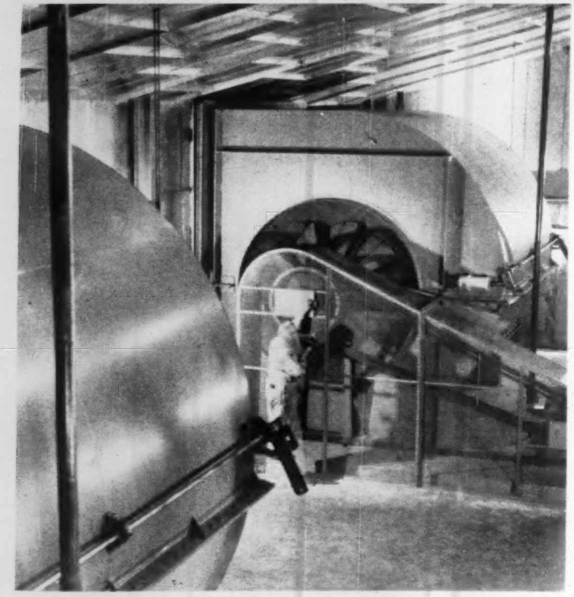
The older, original 13 story structure houses the general offices, composing, and stereotype rooms. The newer, four story, addition accommodates the press, mailing, and news rooms.

The average ceiling height for the entire structure is about 11½ ft. The building is 153 ft by 245 ft, and 1½ million cu ft are air conditioned. The main reason air conditioning was installed was to provide greater employee comfort. There are 1100 employees working in three shifts.

A total of 86 zones are required to take care of the various exposures and load variations. Adjacent rooms or zones may be supplied with widely varying temperatures. If one room is to be held at 68 F, the next room may be held at 80 F if desired. The system adjusts fully and rapidly to widely varying outside temperatures, ready to supply air at temperatures ranging from 180 F to 40 F.

The wide range of room temperatures desired made air conditioning from a single system difficult.

The installation was further hampered because no provision for ductwork and other air conditioning equipment was made in the original plans. Consequently, much



TWO HUGE FANS — centrifugal airfoil type — supply 375,000 cfm of conditioned air throughout the plant. System operates 22 hours per day. Note sheet metal ceiling of room

of the ductwork had to be installed on the exterior of the building.

Two Fans Move 375,000 Cfm of Air

It was decided to install the fans and most of the ductwork in a large sheet metal penthouse on the roof of the four story annex. The sheet metal casing is nearly 2½ stories high, about 65 ft wide, and 125 ft in length. 400,000 lb of sheet metal were used for the entire job, including ductwork. Two huge 80¾ in. diam, double width centrifugal airfoil fans move a total of 375,000 cfm of air for the entire installation.

In addition, all other large moving equipment is in the one equipment room. But with the fans, compressors, pumps, and cooling tower equipment operating, no noise or vibration can be heard or felt in the building, even on the floor directly under the penthouse.

The fans are backwardly curved airfoil, nonoverloading, and are about 15 ft high. Each fan changes capacity with the seasons by a vortex control at the inlet.

Other equipment includes two large compressors and four 25 hp centrifugal circulating pumps. One of the two 500 ton compressors has a compressor speed control which gives capacity control from 10 to 100 percent.

The cooling tower on the roof utilizes three cooling tower fans, since the cooling system is used most of the year. In cold weather, the water bypasses the tower and moves through the tower basin to an inside storage tank, thus preventing the condenser water from freezing.

Cooling and Heating Coils Are 65 × 26 Ft

Other highlights of the system are cooling and heating coils 65 ft wide and 26 ft high, making them the largest in the U. S. A single bank of air filters is also the largest in the country in such an installation, measuring 23 ft high and 65 ft wide. Air cleaning is accomplished by electrostatic air filters.

The cooling coils are six rows deep and are designed for counterflow heat transfer.

The system will handle as much as 100 percent outside air. When the outside temperature is 50 F or less, mechanical refrigeration is not required.

Electrostatically cleaned return air is used to temper the cool air supply, thus eliminating the necessity of reheating during most of all seasons. Reheat is used only on very humid days. The return air raises the temperature of the outside air above freezing.

In the stereotype department, where the foundry equipment is located, lead melting pots occupy 800 sq ft of floor space. To offset the heat generated by this operation, 40 tons of air conditioning capacity is supplied. This is 1 ton for every 20 sq ft, compared to 1 ton for every 300 to 400 sq ft in the average office building.

At present, three floors of the original building are heated as well as cooled by the new system. Eventually, the heating will be expanded to include the total building. As the present heating system is replaced, the exterior zone ducts will be lowered under the windows to deliver heated air into these areas.

All the exhaust air, with the exception of the washroom exhaust air, is taken from the pressroom. This 45,000 cfm cools the room and keeps the air clear of ink and paper mist. The exhaust air from the pressroom is then discharged to the truck loading dock. Here it provides comfort for the delivery truck drivers.

Every floor has a south zone as the building faces south. The long sides of the building face east and west, so every floor has two zones on both the east and west sides. In addition, there is one north zone per floor.

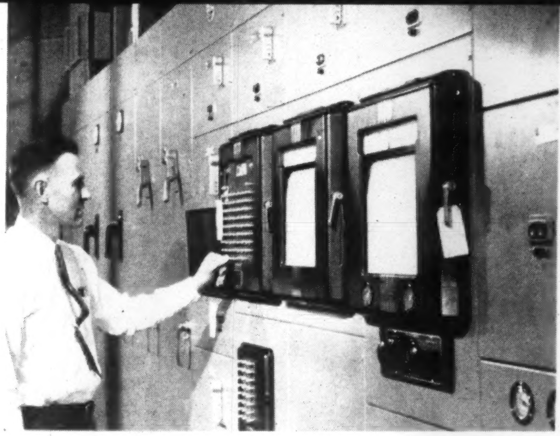
Air Shafts Installed On Building Exterior

Four shafts carry all the supply and return air. These shafts are on the outside of the building, so no floor space is used. One shaft is on the east side, two are on the west side, and the fourth is on the north side.

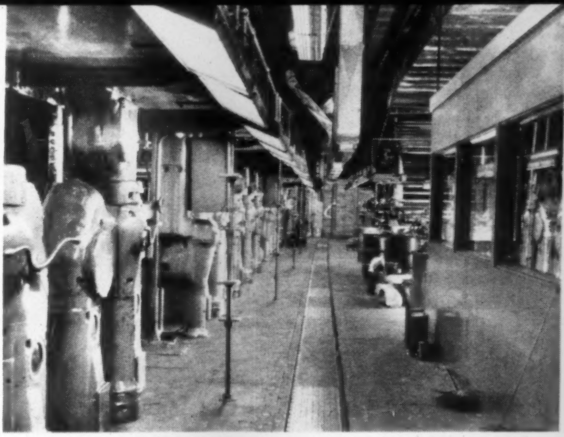
Ducts branch off the shaft at the ceiling of each floor to mixing boxes. From these boxes supply ducts are run to each zone as required for the various floors. All ducts are designed for ceiling type air distribution except for the northeast zones. Here, under the equipment room, three new floors were constructed. The supply ducts for the exterior zones on these floors were brought in under the windows, and they supply air for both cooling and heating.

Throughout the entire building, all exterior zones except for the industrial area, have outlets on each corner of every column. These four outlets serve one-quarter of the bay they face. This arrangement of ceiling outlets will permit partitioning the bay into four small offices without interfering with the air distribution system.

The linotype room is zoned like the conventional floor but it has two extra zones directly over each of the 30



CONTROL PANEL registers air temperatures and supply air temperatures for each of 86 zones at flick of switch. Byron B. Carpenter, engineering supervisor, keeps tab on system



PRESSROOM has eight high speed presses, separately zoned. Air supply ducts enter at ceiling and extend to each folder. A downcomer on each side branches to a tee with outlets

linotype machines. When the linotype machines are in operation, the two linotype zones supply the additional cooling required. If the owner should desire to change or move the linotype department, only the linotype ducts need be changed.

The horsepower for eight high speed presses totals 1710 hp. This does not include accessory horsepower. To handle this load, the air supply ducts are brought in at the ceiling of the pressroom to each folder and its units. Two ducts drop from the ducts at the ceiling to within 7 ft of the press deck, one on each side of the press. On each drop there is a tee at the 7 ft level, and outlets are run the full length of the press. With this arrangement, each press is a zone.

Central Master Panel Controls System

A central temperature control panel records temperatures from every section of the building. Studded with gages and dials, the big board enables engineering personnel to keep an accurate account of all ventilating and air conditioning conditions.

A specially designed temperature indicator on the panel provides: (1) the temperature in each zone and (2) the temperature of the air being supplied to each zone. These two temperature readings enable the operator to make the necessary adjustments for controlling each zone.

On the chilled water circuit, a temperature recording chilled water controller with its bulb in the chilled water line controls a hydraulic speed regulator on compressor No. 1. When No. 1 compressor reaches 475 ton capacity, it goes off the line and No. 2 compressor comes on the line at 500 tons. When its capacity is exceeded, No. 1 compressor again comes on the line and furnishes whatever additional capacity is required, up to 1000 tons. As the capacity is reduced, No. 1 compressor follows the load down to 500 tons, then goes off the line. As the load goes below 500 tons, No. 2 compressor goes off the line and No. 1 comes on and follows the load down as required.

On the hot water circuit there is an outdoor master thermostat that resets a submaster thermostat which controls the steam valve on the hot water heater. The same master thermostat resets a submaster thermostat in the hot deck of the unit. This submaster thermostat controls a three way valve and allows the hot water to go through the heater or bypass the heater as the heating load demands. There is also a gradual relay which allows the operator to reset the hot water temperature.

Humidity control is accomplished by injecting steam into the outside and return air mixture, through a perforated pipe which extends 75 percent of the width of the equipment room, and is directly in front of the coil bank. Control of the quantity of steam used is accomplished by a humidistat in the return air plenum chamber which in turn controls a steam flow control valve.

On the condenser water circuit considerable power is saved by using equipment designed so that only the required amount of pump and cooling tower fan horsepower is used. The temperature of the inlet water to the condenser on a centrifugal compressor is critical and water below this critical temperature produces unstable operation of the compressor.

So to maintain control of the water temperature to the condenser, the equipment was designed as follows. Each compressor has its own condenser pump and is wired so that the condenser pump must be started before the compressor is started. This also applies to the chilled water pumps.

The cooling tower with three fans lends itself to step capacity control of the condenser water temperature. Also, the cooling tower is located so that the air intake faces the prevailing winds. This will result in many hours of fan horsepower savings, during the years of operation.

The system provides five steps of condenser water temperature control.

The total cost of the air conditioning was $910,150. This does not include building construction costs of the equipment room and the three new floors below it.

Brooks-Borg, Inc., and Amos Emory were the building architects and engineers. Conditioned Air Corp. was the air conditioning contractor. ≠

Photos courtesy Chicago Blower Corp.

Operating records of 20 hospitals show why . . .

Insulation Is a Rich Investment in

Figures show that the extra cost of insulated walls and double glazed windows can be offset by safe reduction in the size of the heating plant, which can cut the fuel bill in half, says the author.

BY CHARLES F. NEERGAARD
Hospital Consultant, Retired

THE INSULATED HOSPITAL has an endowment built into its plant. It is cooler in summer, warmer in winter, and uses only half as much fuel for heating. While the better walls and double glazed windows are more expensive, we have found in many hospitals that the savings which the engineer can make in safely reducing the size of the boilers and radiators can substantially offset this. Thus, the overall building budget is not increased, while the annual fuel bill which has been cut in half yields big dividends for the life of the hospital.

Some designers, for over 25 years, have been using insulation generally. But in many other cases, where insulation has been neglected, hospitals are wasting thousands of dollars each year.

My first experience with insulation was in 1932 for the Prince Edward Island hospital, Charlottetown, P. E.I., Canada. There winters are cold, fuel expensive, and funds scarce. With walls heavily insulated and the windows triple glazed, that hospital — now with 200 beds — has operated for almost 26 years on two 60 hp boilers.

Since then I have consistently urged hospital insulation. Some critics claim that insulation and double glazing are prohibitively costly and that the heating plant could never be safely reduced enough to save the extra cost. But in actual cases in my experience radiation and operating costs have been reduced with insulation, and often they might have been reduced still further.

Insulation Saves Five Ways

Complete insulation cuts costs five ways:

1) It can cut the size of the radiation in half.

2) It can cut the size of the heating boiler in half.

3) It can cut the fuel bill in half for the life of the building.

4) It cuts patient and personnel discomfort from cold walls and windows.

5) It cuts the fee for the consulting engineer.

How Four Hospitals Were Insulated

The four pioneer hospitals listed in Table 1, *A, B, C,* and *D,* were insulated as follows: The walls had a *U* factor of 0.095. In cross section there was a 12 in. brick wall, waterproofed on the inside. There was a 2 in. air space. A large, 3 in. thick, fireproof furring slab of wood fiber and insulating cement was finished with ¾ in. of plaster. The roofs had similar protection. This construction was economical and effective.

The windows, about 30 percent of the wall area, had tight metal frames and casings, were well gasketed, and were double glazed with ½ in. insulating panes.

The four building contractors who erected these structures reported that the savings in radiation and boilers substantially offset the additional cost of the walls and windows.

With adequate wall and window insulation, the heat-

The author, a hospital consultant for over 35 years, has served as advisor on over 350 hospitals. He has had several previous articles published in HPAC. In the most recent — November 1956 — he urged cutting waste in the mechanical plant by not overdesigning the heating plant.

GLENS FALLS, N. Y., HOSPITAL, a compact unit under one roof, is a good example of what an insulated addition can accomplish. Its operating cost is $0.65 per patient day, compared to the $1.10 average of 20 hospitals surveyed

Comfort, Economy

ing plant can be cut in half, as shown in Table 1. Hospitals *A*, *B*, and *C*, engineered by Charles E. Daniel, support the validity of his formula that for zero F design temperature, 1 sq ft of radiation will heat 160 cu ft of insulated building, whereas without insulation, 1 sq ft will heat only 80 cu ft.

The Bethlehem Pavilion, *A*, of five stories, has the highest ratio, 1 sq ft to 200 cu ft. It has the double corridor plan and indicates the heating economy of this layout. In the 14 ft service area between the corridors are eight utility spaces on each floor which need no direct radiation. With the single corridor plan, each utility space would have been on an outside wall and 32 additional radiators would have been required.

Hospital *H*, Toronto, is mechanically ventilated throughout by 24 supply and 48 exhaust systems. A total of 78,700 cfm of 100 percent outdoor filtered preheated air is supplied with no recirculation except in the auditorium. The plant is designed for the future addition of cooling.

Hospital *L* has an elaborate system of ventilation under the New York city building code for interior space and occupany. Fourteen fans supply 165,000 cfm of air, with 60 percent recirculation, and 23 fans exhaust 159,000 cfm. Total fan horsepower is 140 hp. The four lower floors — used for clinics and auxiliary services — and surgery total about half of the building space and are air conditioned. This hospital has a modified double corridor plan.

Comparisons Show How Much Insulation Saves

Comparison of plant operating costs is necessarily subject to many variables: the size and construction of the buildings to be heated, the efficiency of the plant design and operation, the design temperature, cost of fuel, and other factors.

It is unfortunate that the cost of heating the insulated Pavilions *A*, *B*, and *D* cannot be segregated. When comparing the operating costs of the entire plant, the saving effected by one insulated pavilion can be only suggestive. For example, Bethlehem has seven or eight widely scattered old buildings with over three times the bulk of the new wing. Its boiler plant is conventional. New Haven's five older structures are spread around an entire city block. Its operating costs would have been considerably less if the engineer had made the full reduction in radiation which the insulation warranted. Its boiler plant is conventional. But compact Glens Falls — under one roof with a flexible three boiler plant — even with only its walls insulated, is a good example of what an insulated addition can accomplish.

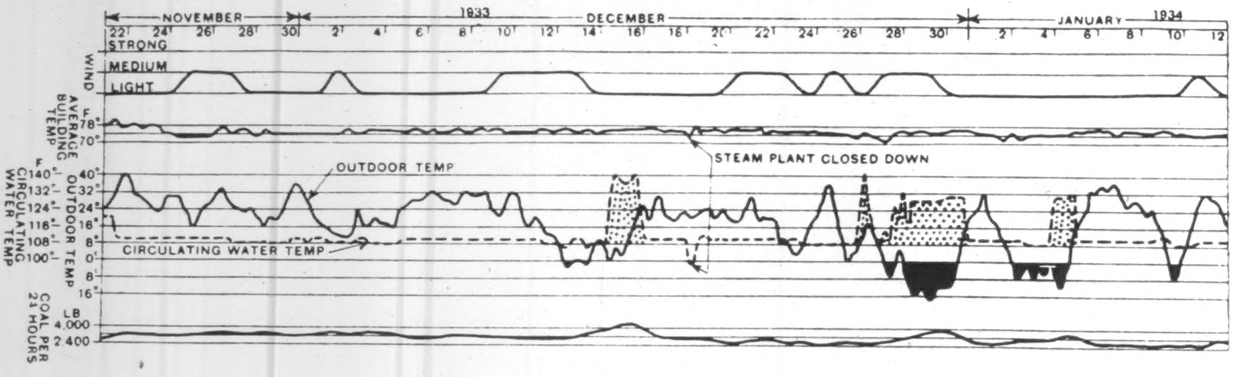
The operating figures in Table 2, Part 2, furnished by the eight hospitals with more or less insulation are adjusted to conform to the auditors' standard accounting. The expenditures of these eight hospitals when compared to the average of the 20 hospitals demonstrate that insulation pays. The auditors' estimate that the total mechanical plant operation for the 20 hospitals on a per diem basis is 5.56 percent of the basic operating expenses — a relatively small percentage.

But consider this. If the 20 hospitals whose average spending of $1.10 a patient day were as economical to run

TABLE 1—WALL AND WINDOW INSULATION permits cutting the heating plant in half, as shown here. For zero F design temperature, 1 sq ft of radiation will heat 160 cu ft of insulated building, whereas without insulation 1 sq ft will heat only 80 cu ft

Hospital	Building volume, gross cu ft	Radiation, sq ft	Ratio of cu ft per sq ft of radiation	Insulation		Design temperature, F, approximate
				Walls	Windows	
Conservative engineering						
A) Bethlehem, Pa.	750,000	3750	200	Yes	Yes	0
B) Glens Falls, N.Y.	605,000	4400	137	Yes	No	−10
C) Hagerstown, Md.	560,000	3590	156	Yes	Yes	0
D) New Haven, Conn.	1,605,000	13,248	121	Yes	Yes	0
E) Prince Edward Is., Canada	550,000	5100	107	Yes	Yes	−10
F) Toronto Western	1,880,000	16,600	113	Yes	Yes	−10
G) Mt. Sinai, Toronto	3,110,197	30,500	102	Yes	Yes	−10
H) Sick Children, Toronto	5,874,347	55,100	106	Yes	Yes	−10
Extravagant engineering						
I) Long Island	514,000	7320	70	Yes	No	0
J) New Jersey	425,000	6600	65	No	No	0
K) Virginia	1,137,521	23,813	47	Yes	No	+10
L) New York City	2,500,000	49,500	43	Yes	No	0

A, *B*, *C*, *D*, and *F* are additions to existing hospitals. All others are complete new hospitals.



PRINCE EDWARD ISLAND HOSPITAL, built in 1932, very well insulated and

as the Glens Falls hospital, which spent $0.65 a patient day, the annual saving would aggregate $900,000 or 4 percent interest on a $22½ million endowment.

Or take another comparison. If the New York hospital, No. 2, with 556 beds has to spend $233,400 yearly for plant operation, and the Toronto hospital, *F*, with 725 beds, with less than half of its buildings insulated, spends only $183,400 a year with a 10 F lower temperature, insulation is valuable. The Toronto hospital used 450,000 gal of fuel oil at $0.1063 per gal. At $0.066, the cost in the U. S., it would have saved $18,000 and reduced its plant operating cost to $165,400, compared with $233,400 for the New York hospital with 169 fewer beds.

Hospital *L*, with half of its building air conditioned,

TABLE 2—MECHANICAL PLANT OPERATING COSTS in 1954-55 compared here for 20 hospitals in four Middle Atlantic states indicate that insulation saves money. The 20 hospitals range from 694 to 279 beds in capacity. Statistics are weighted: three infant days = one adult day; three bassinets = one bed. Courtesy MacNicoll Roswell & Co., auditors for 62 hospitals

Total expenses for 20 hospitals			Average cost per patient day
Salaries and wages	$787,046		$0.40
Fuel	688,374		0.35
Water	48,623		0.02
Electricity	367,599		0.19
Miscellaneous	279,874		0.14
	$2.171,516	Total	$1.10

Salaries and wages include only light, heat, power, and elevator employees, who are 2.19 percent of the total employees. Total plant expense to total basic operating cost on a per diem basis, omitting special departments such as laboratory and xray, is 5.56 percent. Owning costs — amortization, interest, and insurance — are not included.

AVERAGE OPERATING COSTS for the 20 hospitals and individual breakdowns for the five hospitals with the highest costs are shown below. Practically all of these plants in Part 1 are steam heated; only three have any insulation in their buildings.

Part 1

Hospital	Beds	Days care	Total cost	Per patient day	Total fuel cost	Per patient day
Group average, Nos. 1-20	6833	1,971,865	$2,171,516	$1.10	$688,374	$0.35
No. 2, N.Y. City	556	160,001	235,481	1.46	84,846	0.53
No. 3, N.Y. City	420	118,417	170,480	1.44	69,010	0.58
No. 4, N.Y. City	345	97,734	172,956	1.77	41,156	0.42
No. 5, N.Y City	262	73,400	100,614	1.37	28,903	0.39
No. 15, Long Island	319	85,704	156,009	1.82	31,355	0.37

Part 2

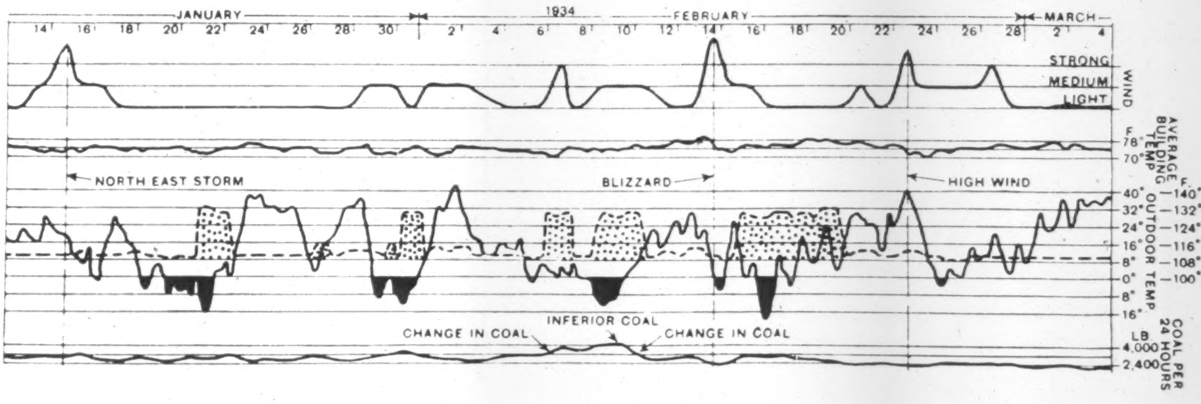
Hospitals heated with hot water and with all or part of their buildings insulated. Hospital	Beds	Days care	Total cost	Per patient day	Percent insulated	Total fuel cost	Per patient day
A) Bethlehem	374	119,299	$105,232	$0.92	1/3	$38,090	$0.33
B) Glens Falls	252	74,026	52,099	0.65	1/2	12,404	0.167
D) New Haven	383	110,454	96,243	0.87	1/2	25,700	0.23
E) Prince Edward Is.	210	39,473	37,715	0.96	All	13,859	0.35
F) Toronto Western	725	213,392	183,473	0.86	1/2	51,516	0.244
G) Mt. Sinai, Toronto	355	114,263	127,933	1.12	All	37,998	0.33
H) Sick Children, Toronto	647	170,017	205,136	1.19	All	76,493	0.45
L) N.Y. City	170	49,849	107,099	2.75	1/2	14,256	0.28
Hospitals with summer cooling but without insulation							
J) Long Island Jewish	224	67,277	135,325	2.02	0	30,305	0.46
K) Pearsburg, Va.	68	15,607	20,325	1.30	0	4,219	0.27

Fuel oil prices during this period were $0.566 to $0.66 per gal in the U. S. and $0.1063 per gal in Canada.

Hospitals *G*, *H*, and *L* buy metered steam from medical center plants. Their fuel costs include owning costs, omitted from the other figures.

Hospital *H*, Toronto, has conditioned air without cooling. Twenty-four supply fans deliver 78,700 cfm of 100 percent outdoor air through the building, with 48 exhaust fans.

Hospital *L*, N. Y. City, has complete air conditioning on its four lower floors. Fourteen supply fans deliver 165,000 cfm of air, of which 60 percent is recirculated. There are 23 exhaust fans. Total fan horsepower is 140.



triple glazed, was not affected by sudden fluctuations in outdoor temperature

has two systems of heating: 10,500 sq ft of direct hot water radiation (1 sq ft to every 204 cu ft for the building); and 39,000 sq ft of indirect radiation to heat the 165,000 cfm of outdoor air (nearly four times as much as for heating the building. The total radiation is 49,500 sq ft. The resulting operating cost of $2.19 per patient day is the highest in the group. The hospital's large outpatient attendance as related to its inpatient days should be considered in the unit cost.

Could Have Cut Radiation Over 50 Percent

The operating record of Prince Edward Island hospital, E, Fig. 3, shows clearly that its radiation could have been materially reduced. During the winter of 1934-35 a daily chart for this hospital was kept, showing the outside temperature, the average temperature in the building, the temperature of the circulating water, the wind conditions, and the fuel burned.

The walls of this hospital have a *U* factor of 0.106. The windows — 2¾ in. thick — have three gasketed ⅞ in. sash which can be opened for cleaning. The windows are believed to have as much to do with the operating results as the wall and roof insulation.

The system was designed to circulate water through the radiators up to 200 F, but the chart shows an average of only 108 F throughout the winter, which maintained a building temperature 70 F or higher. On January 17, with the outdoor temperature of −20 F, the circulating heating water rose to only 130 F. In three days of below zero weather in December with a low of −18 F, the heating water averaged only 136 F. High winds and blizzards had little effect on comfort, and with rapid temperature drops to subzero, there was a time lag of from three to five days, while the heating water temperature rose from 108 F to only 140 F.

The radiation had been reduced by 57 percent of what would have normally been provided to compensate for the insulation and triple glazing. But it is obvious from the operating experience that a larger cut was warranted.

For the 135 bed Virginia hospital, *K*, the consultant, at the start, suggested the advantages of insulation, double glazing, and the three unit boiler plant. The building committee approved the insulation, but not the double glazing; and instead of three boiler units totaling 200 hp, two units aggregating 400 hp were installed.

The final plans showed a forced outdoor air ventilating system. The ventilation required 13,000 sq ft of indirect radiation in addition to 10,800 sq ft of direct radiation to heat the building. The result was an overheated building and upward of $100,000 wasted.

Just consider these comparisons. If the New Haven hospital, *D*, could more than adequately heat its 1,600,000 cu ft with 13,248 sq ft of radiation with a design temperature of zero F, why should the Virginia building with 1,137,000 cu ft be overloaded with 23,800 sq ft of radiation for a design temperature of 10 F?

Hospitals *J* and *K* have no insulation, but their relatively low operating costs for year 'round comfort are suggestive.

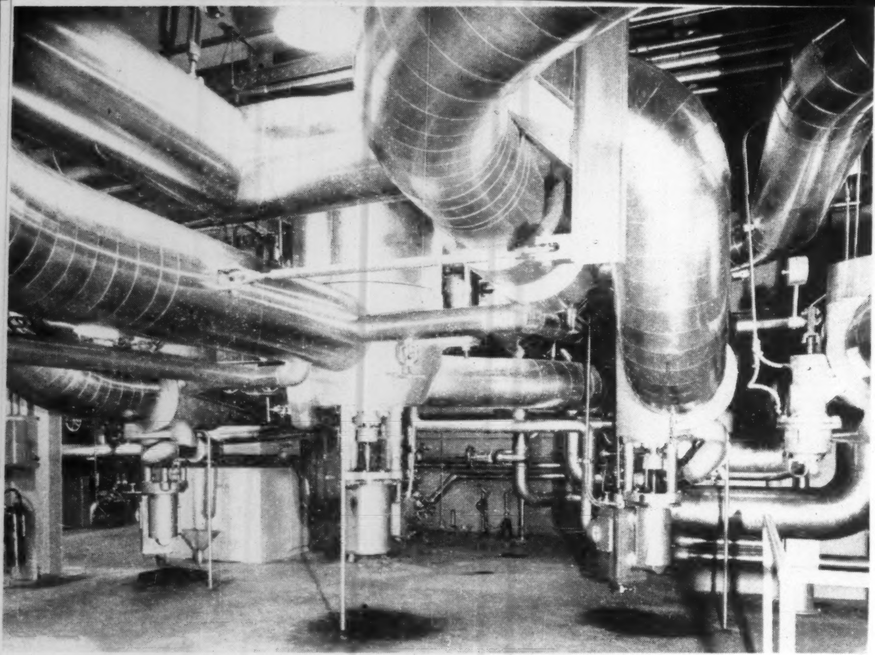
Long Island Jewish hospital, with the double corridor plan, has panel heating and panel cooling. Deep well water is used for the cooling.

The little hospital, *K*, at Pearsburg, Va., was one of the first in the country to install a heat pump for year 'round comfort. Its per capita cost was $1.30 per patient day.

3 In. Wall Insulation Saves Up to 75 Percent

Tables in the Heating, Ventilating, and Air Conditioning Guide for 1956 give the relative heat loss through noninsulated and insulated floors, walls, and windows. With 3 in. of wall insulation, the Guide tables show savings as high as 75 percent. With savings like that, insulation which will make the hospital warmer in winter, cooler in summer, and cut the heating fuel in half, should not be omitted.

The cooling value of insulation is particularly significant also. Several week long tests, in several hospitals in the U. S. and Canada — with recording thermometers in adjoining buildings with and without insulation — demonstrated that the insulated structures average 8 F cooler in summer, without air conditioning. ⧺



MAIN STEAM PIPING AND STOP VALVE, center, with hot reheat piping and stop valves on each side are evidence of complex calculations required for this installation at the Suwannee River plant of the Florida Power Corp. Flexibility analysis of similar five-anchor main steam piping and hot reheat piping systems for a 120,000 kw reheat machine — operating at 1800 psig and 1000 F — resulted in a direct cost saving to the client and eliminated a difficult structural problem of providing restraints in a congested piping area near the turbine. The consulting engineers, Black & Veatch, utilized the digital computer facilities of the Midwest Research Institute

How Giant Brains Aid Piping Design

Flexibility problems that are too complex for human brains are being cracked quickly and economically by automatic digital computers. The author outlines typical current programs, describes briefly the equipment available, and explains his own program for machine calculation. A previous article was in the May HPAC.

BY JOHN E. BROCK
Professor of Mechanical Engineering
U. S. Naval Postgraduate School

THE FORMIDABLE PROBLEMS of piping flexibility analysis are increasingly being solved by those electronic marvels of the computing world popularly known as "giant brains." Exactly what are these giant brains? How do they work?

In the first place, there are two distinct types: (1) analog computers and (2) digital computers.

In analog computers, some geometrical or mechanical or electrical quantity corresponds, by way of an analog, to the quantity under consideration. Most analog computers are designed primarily for the solution of differential equations, usually those describing dynamic systems; and the voltages between certain points in the circuitry correspond to the motions of the dynamic systems.

Another common example of an analog computer is the slide rule. In this, certain lengths on the various scales correspond to the logarithms of numbers which themselves may represent any physical quantities. Adding the lengths by moving the slide and cursor of the rule corresponds to — that is, is the analog of — adding their logarithms of the numbers, thus providing the logarithm of the product of the numbers. The numbers themselves, not their logarithms, are printed on the scales, so we do not have to use a table of logarithms when we use the slide rule.

Digital Computers Are Arithmetic Factories

Digital computers, on the other hand, perform arithmetic operations, A digital computer can do nothing that you can't do with a pencil and a pad of paper and a few million working years to do it in.

In addition to the fundamental operations of arithmetic — addition, subtraction, multiplication, and division — a digital computer performs another very important arithmetic operation often forgotten, that of comparing two numbers and seeing which is the larger.

One more arithmetic operation shifts a number to the left a given number of places, and throws away digits as they move off the left side and introduces zeros from the right; this operation can also shift numbers to the right in the same manner.

The author is a member of HPAC's board of consulting and contributing editors and has written several articles published in HPAC on the subject of piping design.

When it comes to such operations as taking the square root of a number, the machine must use the six fundamental operations in the proper sequence to determine the successive digits of the desired result — in just the same way as you would have to if you were extracting a square root using pencil and paper.

Besides the six fundamental arithmetic operations, the machine can also accept information and make the answers available to the operator. It does this by such operations as:

- "Read punch coded paper tape using automatic typewriter input."
- "Write results using automatic typewriter."
- "Punch results on IBM cards."
- "Read information from punched IBM cards."
- "Record information on magnetic tape."
- "Read information that is stored on the magnetic tape."

It does this by closing electric circuits that operate the typewriter, card punch, or magnetic tape machine at the right time in the calculating cycle.

Computer System Components Vary in Size

The giant brains may indeed be giants that occupy a large room or even several rooms. But one digital differential analyzer — a special purpose computer — takes little more space than a conventional desk calculating machine. Others vary in size.

The National Cash Register Co. NCR-CRC 102A general-purpose electronic digital computer is rather like a big metal box with rounded corners, 6 ft high, 2½ ft wide, and about 4¼ ft from front to back. In operation, it emits a dull roar caused mainly by the blast of air provided by an integral fan which cools the electronic components. On the machine's small face are several toggle switches used mostly by maintenance engineers and 27 little neon eyes which flash on and off so rapidly when the machine is operating that the human eye cannot follow their progress. However, a skilled operator can read these lamps to a certain extent, so that he can at least tell in certain cases what part of its own memory the computer is consulting.

The machine is operated from a console built into a small part of a regular office desk. On the desk is an automatic typewriter — a "Flexowriter" — manufactured by Commercial Controls Corp. This typewriter is the primary means of putting information into the computer and of getting answers out of it. The console, the Flexowriter, and the computer itself are all one needs with this system to solve the most complex problems.

However, for many problems, it is convenient to use some or all of certain auxiliary equipment available for use with the 102A. Two IBM card punch readers may be modified so that one can read information from IBM cards into the computer and the other can punch IBM cards with information taken out of the computer. These devices are each 4 ft high, 3½ ft long, and a little over 2 ft deep.

How Digital Computers Operate

The internal "memory" of the computer itself has only 1024 memory cells, each capable of storing 42 binary digits of information; this is roughly equivalent to nine decimal digits together with an algebraic sign, plus or minus. For some problems, this is not sufficient capacity, and the memory may be augmented by using up to eight magnetic tape auxiliary units, each of which contains over 100,000 memory cells. A disadvantage of the enlarged memory is that it takes the computer a longer time to "look things up on the magnetic tape" than it does to recall things from its own memory. Each of these magnetic tape units is 4 ft high, 2½ ft wide, and 1½ ft deep.

For some problems it is convenient to have the machine draw directly a graph of the results, and this can be done by use of an automatic plotter which is little over 3 ft tall, 2½ ft wide, and 15 in. deep.

In operation, this computer starts out at that place in its own memory where it is instructed to start. It consults its memory cells one after the other to see what it has been told to do. It performs each "command" and then goes to the next memory cell in sequence and performs the next command, and so on.

The NCR-CRC 102A is what is called a "three address computer." Each command is stored in the memory as a 14 digit number, the first two digits being the command itself and the next three groups of four digits each being the addresses, that is, the memory cell identification numbers, of the operands for the command. Thus, 35-1221-1222-2000 means ADD (that's what the 35 says) THE NUMBER LOCATED IN CELL 1221 TO THE NUMBER LOCATED IN CELL 1222 AND STORE THE SUM IN CELL 2000.

Another example: 21-0746-1142-0006 means PRINT (21) USING THE FLEXOWRITER THE CONTENTS OF SIX MEMORY CELLS, STARTING WITH CELL NUMBER 0746, AND IN THE MODE DESCRIBED BY THE NUMBER IN CELL 1142. This mode may, for

ELECTRONIC DIGITAL COMPUTER, right, is combined with special typewriter and other auxiliary units to solve complex problems. Computer can graph results with automatic plotter example, imply that one is printing out numerical results in decimal form and printing only the first five of the nine decimals available. Or it may mean other combinations.

Sometimes, not all of the parts of a command are used by the machine. Thus 11-0552-1456-0200 means START THE PAPER TAPE READING ATTACHMENT OF THE FLEXOWRITER AND RECORD INFORMATION FROM THE PAPER TAPE INTO THE COMPUTER MEMORY STARTING WITH CELL 0200. The computer looks up the contents of cells 0552 and 1456, but it doesn't make use of this information. Accordingly, special addresses which the computer can refer to very rapidly are used in these places. Two such special addresses are 2100, which always contains the number zero, and 3000, which contains certain information about where the computer is in its progress through the computing program.

Example of Brief Program Given

As an example, consider the following very brief program which reads some information to the computer, performs some arithmetic operations on this data, prints out the result, and repeats the whole thing with new data. Suppose the result of $E = AB - CD$ is desired, where A, B, C, and D are given numbers, for a whole sequence of sets $A.B.C.D.$

First a punched paper tape is prepared as follows:

/0200-0100/A_1 B_1 C_1 D_1 sxA_2 B_2 C_2 D_2 sxA_3 B_3 C_3 D_3 sxx

This paper tape is prepared by writing on a Flexowriter (not necessarily the one which is attached to the computer) just as written above, except that the numerical values of the numbers A_1 and so on are actually written. Also, the symbol written above as an "x" isn't really an "x," but is a special key called a "stop code." The spaces indicate that the tabular key has been struck; later on this will cause the computer to gulp the information every time punched holes in the paper tape actuate the tabular key on the Flexowriter connected to the computer.

Also, there are a few other differences. The hyphens indicated in the above sequence and in other places in this article are never actually written down; these have been indicated simply to break the numbers up into handy units for easy explanation.

Next, the Flexowriter connected to the computer is used to fill the following commands directly into the computer memory:

In cell 0200 is put 25-0100-0101-2000.
In cell 0201 is put 25-0102-0103-2001.
In cell 0202 is put 36-2000-2001-2000.
In cell 0203 is put 21-2000-0206-0001.
In cell 0204 is put 11-3000-3000-0100.
In cell 0205 is put 34-3000-2100-0200.
In cell 0206 is put 00-0000-0001-0000.

Finally, the prepared paper tape is inserted into the tape reader part of the Flexowriter connected to the computer and the tape button is pressed. Here's what happens.

The symbol /0200-0100/ tells the computer to start filling information in cell 0100 and to be prepared to start computing in cell 0200. The A_1 goes into the computer in cell 0100 when the first tab comes along. Similarly B_1 goes into 0101, C_1 into 0102, and D_1 into 0103. The s starts the computation (in cell 0200) and the x turns off the tape read motor so that no more paper tape feeds through the tape reader when the computer is computing.

Thus, the computer goes ahead with the command in cell 0200 which tells it to multiply (25) the contents of cell 0100 (where A_1 is stored) by the contents of cell 0101 (namely the number B_1) and record the product, A_1B_1, in cell 2000.

The next command similarly produces the product C_1D_1 in cell 2001.

The third command says subtract (36) from A_1B_1 in 2000 the quantity C_1D_1 in 2001, and put the result, $E_1 = A_1B_1 - C_1D_1$, back into cell 2000.

Next, is printed (21) one cell only, 2000, in the manner described in cell 0206. This instruction tells the machine to print only eight digits.

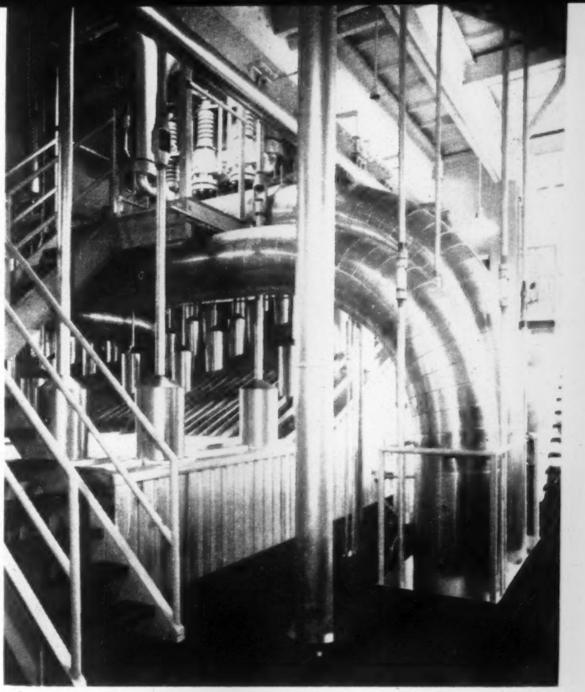
Next, with the 11-command, the Flexowriter is instructed to start the tape reader again and to start filling information in cell 0100. This it does, filling A_2 into 0100, B_2 into 0101, C_2 into 0102, and D_2 into 0103. The s starts the computer going again and it takes up where it left off, executing the command 34-3000-2100-0200. This is a tricky but widely used command intended to obtain an unconditional transfer to the cell indicated by the last four digits.

It works this way: the 34 says compare the magnitude of the contents of the cell indicated by the next four digits with the contents of the cell indicated by the next four digits after that, and if the former is larger, take the next command from the cell indicated by the last four digits. If it isn't, go on with the next command in sequence.

Now, cell 3000 never contains the number zero and cell 2100 always contains the number zero, so that this sequence always instructs the computer to take its next command from the cell indicated by the last four digits. This device is typical of the "tricks" which the computer programmer must use to accomplish his purposes.

Starting over again in cell 0200, the same sequence of commands just finished is executed, this time with the second set of numbers (A_2, B_2, C_2, D_2). In the same way, the third set of numbers is operated on. But here the process stops; it is finished. In the last group (sxx) on the paper tape, the s started the third computation, and the first x turned off the paper tape during the computation. Now at the command in cell 0204, just after third result is printed, the 11-command turns on the paper tape reader and the x which it reads immediately turns it off again. The three answers have been printed out by the Flexowriter.

The computing program above performed some of its operations in cells 2000 and 2001. The operation would have been faster if more data or more commands had



PIPE HANGERS support main steam and hot reheat pipe lines, here leaving pipe chase, at Suwannee River plant. Note close clearances. Main steam piping conditions are 1600 psig and 1015 F. The minimum wall thickness is 1 5/16 in. The 14 in. OD hot reheat piping design conditions are 570 psig and 1015 F. Material for both lines is chrome-moly, meeting ASTM Specification A-335, Grade P-11

been placed in the group of cells 2000 to 2007 inclusive, since the computer is able to refer to these cells more rapidly than it is to its other memory cells, 0000 to 1777 inclusive.

Machine Uses Octal System of Counting

This leads to the next point. Why 1777? Why 2007? Why the 7's? If the program above had been longer, would the next commands have been put in cells 0207, 0208, 0209, 0210, 0211, and so on? No. The computer counts in an odd way. It recognizes no 8's or 9's without special instructions. It counts: 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21 . . . so that "nine" must be written as 11. Thus, the number after 1777 is 2000; and 2000 doesn't mean two thousand, but rather "two times eight cubed," or 1024.

This is the "octal" system of counting and it is used because it goes so conveniently with the binary arithmetic the computer uses internally. The machine can and does accept ordinary decimal numbers like 3.14159265 and can and does put out results like 0.86603 in decimal form. However, before the machine can use decimal information it is necessary to convert these numbers to octal, using the machine itself and a special internal program to do this. Likewise, when the machine has obtained a result, it will invariably be in octal form, and if a decimal answer is desired to be printed, the machine must be instructed to convert the octal answer to decimal form before printing it.

The above example is the simplest sort of program, requiring only seven "words" of command. A piping flexibility program is much more complicated. Not only are many more commands required, but a much larger volume of data must be handled and for complex problems, the main memory of the computer itself is not large enough to handle all the information. Thus, it becomes necessary to store information — numerical data or program commands — in other places, that is, on punched cards or on magnetic tape. In turn, the necessity of reading this information from the main memory onto cards or tape or from cards or tape back onto the main memory requires additional commands, thus adding to the complexity of programming.

Another factor complicates actual programs. Since human programmers make many mistakes, it is good luck as much as skill if a program "works" the first time it is tried. Usually a period of "debugging" is required. In order to "debug" most efficiently, using a minimum of valuable computer time, the program itself should be designed for easy debugging and should, if convenient, contain subprograms designed solely to assist in debugging.

For example, in laying out most programs, the programmer divides the operations into groups which are treated together and called "boxes." One way to assist in debugging is initially to program each box so that the first command in the box is to print out the number assigned to the box. Thus, when computing, the Flexowriter may print No. 1 No. 2 No. 3 No. 2 No. 3 No. 2 No. 3 No. 4 No. 5 00300017761770. This indicates that the program has started out correctly in Box 1 and went on without difficulty until it got into Box 5; having recycled twice through Boxes 2 and 3. However, something went wrong in Box 5; the print 00300017761700 is a typical "error print" which the computer makes automatically when something goes wrong. It assists the programmer in diagnosing his error.

When the program has finally been debugged and is giving correct answers to test problems made up for checking purposes, the programmer can go through and replace all the box-number-print commands by unconditional transfers to the next larger memory cell, thus eliminating all the extraneous printing which was of use only during the debugging period. ‡

In the next article, to be published in an early issue, Professor Brock will outline his own computer program for piping flexibility analysis, actually blocking out one of the subprograms in detail to show how the computer handles a fairly complicated sequence of operations.

Photos on pp. 106 and 109 courtesy Florida Power Corp.; on p. 107, The National Cash Register Co.

Ventilation requirements of commercial, industrial spaces are being revised . . .

New Chicago Ventilation Code Awaiting Approval

To KEEP ABREAST of new developments and new requirements for ventilation of occupied spaces, the present Chicago Ventilation Code has been revised to provide for these changes. The task has not been an easy one, nor has it been done by one person. A special committee was organized to consider how the entire contents of Chapter 81 of the Municipal Code of Chicago, devoted to the subject of ventilation, could be brought up to date.

In the early stages of planning for this revision, it was determined that the present code did not define the conditions adequately for hazardous use applications in industrial areas. Therefore, it was felt desirable to present a section in the new proposed code on industrial applications and refer to the other applications in a commercial section. The special committee responsible for the preparation of the new proposed code, headed by John Dolio, partner in the firm of Shaw, Metz, and Dolio, architects and engineers, general chairman, is:

a) *Commercial Section*
  - William Goodman, consulting engineer, Chairman [Mr. Goodman is a member of HPAC's board of consulting and contributing editors.]
  - E. P. Steinberg, architect
  - S. I. Rottmayer, consulting engineer, representing the American Society of Heating and Air-Conditioning Engineers
  - A. H. Cronin, representing Sheet Metal Workers Union No. 73
  - L. L. Narowetz, sheet metal contractor, representing the Ventilating and Air Conditioning Contractors Association
  - C. R. Kuglin, consulting engineer, representing the Chicago Association of Consulting Engineers

b) *Industrial Section*
  - E. P. Heckel, consulting engineer, Chairman, representing the American Society of Heating and Air-Conditioning Engineers [Mr. Heckel is a member of HPAC's board of consulting and contributing editors.]
  - M. D. Kalisher, architect, representing the American Institute of Architects
  - Silas Cartland, consulting engineer, representing the Chicago Association of Consulting Engineers
  - S. J. Troutman, representing Sheet Metal Workers Union No. 73
  - P. R. West, sheet metal contractor, representing the Ventilating and Air Conditioning Contractors Association
  - Rudolph Houkal, consulting engineer, representing the Chicago Association of Consulting Engineers

c) *Ex-officio members (all of the City of Chicago)*
  - John J. Aeberly, chief, Bureau of Heating, Ventilation, and Industrial Sanitation
  - A. H. Zimmerman, assistant chief, Bureau of Heating, Ventilation, Industrial Sanitation
  - Richard L. Baran, chief, Div. of Industrial Hygiene and Hazardous Use Control

Code Last Amended in 1947

Each section of the committee considered the entire code having to do with ventilation of the spaces in which their respective applications were concerned. The last time the code was amended was in 1947, but it had not been completely revised since 1939 as there had been no real need for this since the desired changes could be accommodated rather easily by means of amendments.

While it may be premature to outline the specific sections of the new proposed code that are significantly different, the highlights of these new proposed provisions are presented here as an indication of what is being changed. After the code has been adopted, it is planned to publish it in a future issue of HPAC.

General Provisions Cited

Ventilation is defined as providing and maintaining in rooms or spaces by natural or mechanical means, air conditions which will protect the health and comfort of the occupants in the space.

The ventilating requirements shall be based on the purposes for which the rooms are used, regardless of the building or structure in which it is located.

Only Effective Area Need Be Considered

In any factory room or department used for food, beer, or malt processing, where a large area is occupied by closed tanks, vats, kettles, or other permanently installed closed equipment — thus leaving a reduced floor area and work space for a few process attendants — the minimum ventilating requirements given in the code shall be adjusted to conform to the following:

a) Rooms in which the total area of ventilating opening is 5 percent or more than the employees' net work floor area may be ventilated by natural means.

b) Rooms in which there are no ventilating openings or less than 5 percent of the employees' net work floor area must be ventilated mechanically by supplying 1.0 cfm per sq ft of net work floor area.

Work Shop Requirements Stated

When the work in the room is of such character that dangerous or noxious dust, fumes, mists, gases, odors, or other contaminants harmful to workers are given off, sufficient local mechanical exhaust shall supplement the other provisions for ventilating the space so as to remove the emission at the source and to prevent the escape of such contaminants to the occupied space. This mechanical exhaust shall be discharged to the outdoor atmosphere, and suitable means for the collection and removal of the contaminants shall be provided. The total air supplied from out-of-doors shall be equivalent to, or greater than the total air volume removed by the general and local exhaust systems.

Air for Cabinet Spray Booths

Cabinet spray booths for which the exhaust requirement per code does not exceed 5000 cfm, indirect air supply to the booth from the adjacent area shall be permitted, provided that the maximum volume of air exhausted does not exceed the equivalent of 1½ air changes per hr within the adjacent area.

Provide for Recirculated Air

The air supply for every ventilating system, either natural or mechanical, shall be taken directly from out-of-doors, except:

a) When air is supplied by a mechanical ventilating supply system, a portion of the code required air supply may be recirculated, provided the system is equipped with such devices for control of temperature, and dust content in the spaces to be ventilated and that the conditions of the air so supplied, (except as to temperature) are substantially the same as though all of the supply air were taken from out-of-doors. The portion or volume of air so recirculated may be considered as exhaust from the rooms from which it is withdrawn. Under such conditions, not less than 33-1/3 percent of the code requirements shall be taken from out-of-doors by the mechanical ventilating supply system; and 66-2/3 percent of the code requirements may be recirculated air, plus any additional air volume of system design capacity in excess of code requirements.

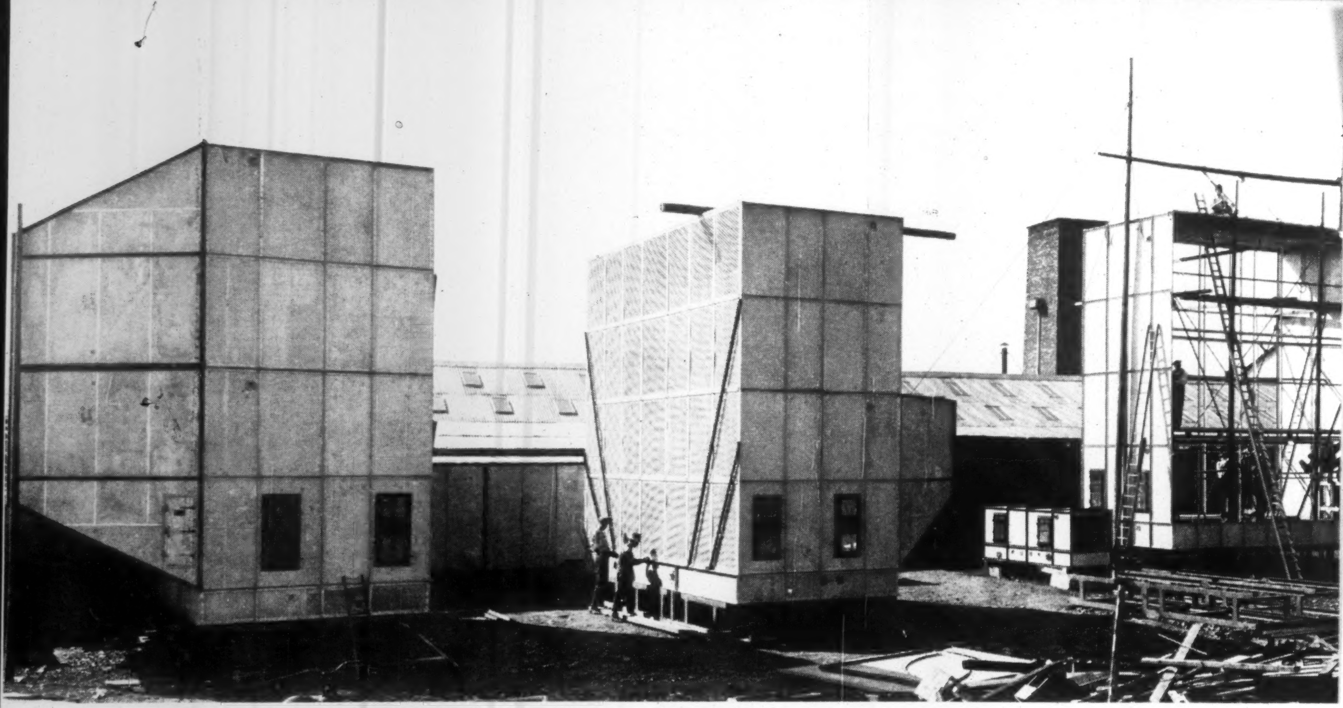
A greater portion of the code-required air may be recirculated, provided the system is also equipped with effective adsorption devices so the conditions of the air so supplied (except as to temperature) are substanially the same as though all of the supply air were taken from out-of-doors. Under such conditions, not less than 15 percent of the code requirements shall be taken from out-of-doors by the mechanical ventilating system; and 85 percent of the code requirements may be recirculated air.

Where adsorption equipment is used, means for maintaining the effectiveness of the adsorption process shall be provided. All equipment shall be so arranged that at least 50 percent of the required air supplied by the system may be taken from out-of-doors. The outside air intake shall be so arranged that at least 100 percent of the required air supplied by the system can be taken from out-of-doors.

b) When air is supplied by a mechanical ventilating supply system which is not equipped with devices prescribed in (a) then only such portions of the air volumes of the system design capacity in cfm that exceed the total code requirements in cfm may be recirculated during the time of room occupancy. The air intake and all equipment and ducts shall be so arranged that all of the code required air supplied by the system can be taken from out-of-doors, with provisions made for release or exhaust of such air to the atmosphere.

Fire Prevention in Ducts Clarified

The materials used in every mechanical ventilating air supply and air exhaust systems shall be of sheet steel or other approved materials. Materials shall be non-absorbent and of moisture resisting character, which will not burn, char, or contribute to the intensity of fire flame spread when in contact with fire. This requirement does not apply to air filters as used for air filtering systems, and acoustic material as used inside ducts for sound reduction. ⧺



EVAPORATIVE COOLING SYSTEMS were often of considerable size. These three supplied about 450,000 cfm of air to a cotton mill in India

How "Trial and Error" Evaporative Cooling Pioneered Air Conditioning

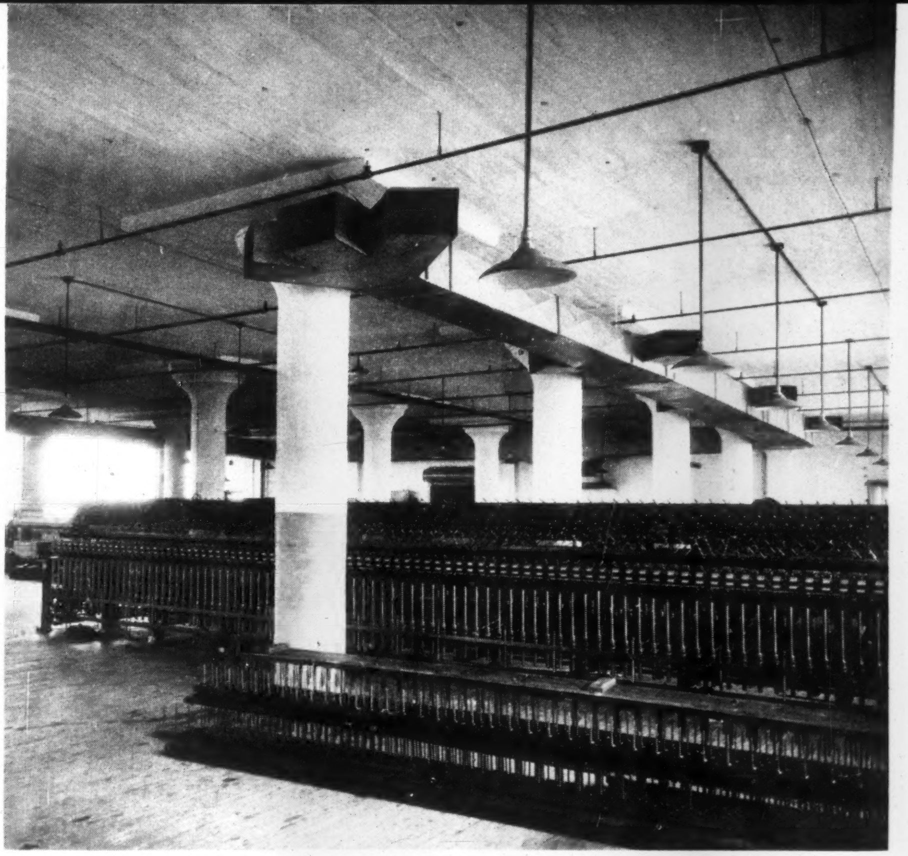
Commonplace today, air conditioning practices and fundamentals derived from evaporative cooling were hard won by the early pioneers. Arduous efforts in research and development — in theory, design, and application — forged the basic concepts underlying the industry today.

BY LOGAN LEWIS
Vice President
Carrier Corp.

AN ERA that had a profound effect upon the development of evaporative cooling and the whole air conditioning industry was the early period from 1899 to 1920. During those years, industry pioneers forged the engineering practices and fundamentals of evaporative cooling that gave birth to air conditioning.

This "child" had been named in advance. Compressed air nozzles and other devices for atomizing water had been developed and used for humidifying textile mills. The way in which they worked was almost literally that of "pumping the humidity up." Evaporation provided some cooling effect, but how much depended entirely upon the whims of infiltration as encouraged by open windows and roof ventilators.

Stuart W. Cramer, of Charlotte, N.C., first used the term "Air Conditioning" in promoting an improved atomizer which was patented in 1906. Exactly what may have inspired this coinage is unkown. Undoubtedly, Mr. Cramer was aware that textile fibers could be "conditioned" much more uniformly by exposing them to humid air than by sprinkling them with water. Carrier Air Conditioning Co.*, organized in 1907 as a subsidiary of Buffalo Forge Co., put the term to a wider commercial use.



CONDITIONED AIR OUTLETS were little more than holes in a duct about 1915. Duct construction, however, was well refined

The first installation of a central apparatus for air conditioning also preceded the christening. The Sackett-Wilhelm Co., of Brooklyn, N.Y., instituted, in 1902, a search for a man who could devise a system for controlling humidity in their multicolor printing plant. They wanted to free themselves from weather troubles.

The man turned out to be Willis Carrier, and the plant which he designed employed refrigeration for reducing the moisture content of air by condensing it upon crude coils of 2 in. pipe. This venture into a new field aroused a new interest. He already had an interest in hot blast heating systems, and here was a new application that might create a new market for the component parts.

The development of air washers for cleaning the air which was used in ventilating public buildings had also preceded the christening. John Zellweger, of St. Louis, Mo., had, in 1899, conceived the idea of washing air by wetting the blades and the housing of the fan which handled it. Richard H. Thomas, of Chicago, Ill., had designed the "Acme Washer" in 1900 which relied primarily on contact between air and sheets of water. Willis Carrier, as chief engineer of the Buffalo Forge Co., followed closely with a design which featured a multiplicity of spray nozzles and an eliminator — patented January 2, 1906 — which would remove minute particles of water.

Humidify Cotton Mill

Practical experience with air washers demonstrated that air was humidified and cooled as it was being washed. This effect on room conditions, pointed toward another potential market, as high humidities were known to be of considerable value in textile processing. As a result, a washer was sold to the Chronicle Cotton Mill, Belmont, N. C., and installed about 1906.

Follow-through promptly revealed some encouraging results and some wholly unanticipated failures. After a means of heating the spray water had been provided, the desired relative humidity could be maintained, but only as long as heating was required. But the heating season for a textile mill was much shorter than the winter. Internal heat came from somewhere, and in a spinning room the gain was usually greater than the transmission loss. The Chronicle Mill washer had been installed as part of a hot blast heating system and was sized for heating instead of cooling requirements.

With the approach of summer, the mill's dry bulb temperature went up and up; and relative humidity went down and down until it had fallen about 30 percent below the desired level. Adding more spray nozzles and hiking the water pressure helped some but not enough. Textile

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*Carrier Engineering Corp. was organized in 1915 by seven employees of Carrier Air Conditioning Co. In 1930 Carrier Corp. was formed by a merger of Carrier Engineering Corp., Brunswick-Kroeschell Co., and York Heating and Ventilating Corp.

mills needed a constant relative humidity throughout the year. Raising the dew point of ventilation air helped with humidity but, at the same time, raised the DB temperature and made a hot place still hotter.

Refine Humidifier Design

An investigation of causes brought three previously unrecognized facts to light. (1) Relative humidity would be constant over a fairly wide range of DB temperature, if and when the difference between DB temperature and dew point — dew point depression — temperature was approximately constant. (2) To do this, the system had to absorb heat in order to hold the DB temperature down. (3) The preponderant source of internal heat was the power transmitted by seemingly guiltless countershafting and belts or ropes and expended in driving mill machinery.

Analysis also made it clear that the size and cost of a system could be reduced to a minimum if the cooling or saturating efficiency of the washer could be increased. This spurred refinements in design. More nozzles with smaller orifices were added and higher water pressures were utilized. Saturating efficiency was raised from around 65 percent to a full 100 percent. The new model was called a "Humidifier" and was first described in the 1906 edition of a catalog entitled "Buffalo Air Washer and Humidifier." This was real progress as it cut the requisite air volume drastically, about in half for humidities above 75 percent.

Calculate Solar Load

Meanwhile, solar radiation had also been recognized as an important factor in the cooling load. It was first used in the calculations for the Huguet Silk Mills, Wayland N. Y., in 1906. "Ned" Stacey — later a vice president and member of the board of the Carrier Engineering Corp. and now senior consultant with the Carrier Corp. — searched the library in Buffalo and found that the French government had made some observations in the Sahara desert and had published the data. Mr. Carrier worked out correction factors for angles of incidence and for glass, wall, and roof surfaces. In 1907, "Ed" Heckel — also a vice president and member of the board of the Carrier Engineering Corp. later on, and now a consulting engineer — supervised the installation of the system, including the round ducts that were commonly used in hot blast heating practice.

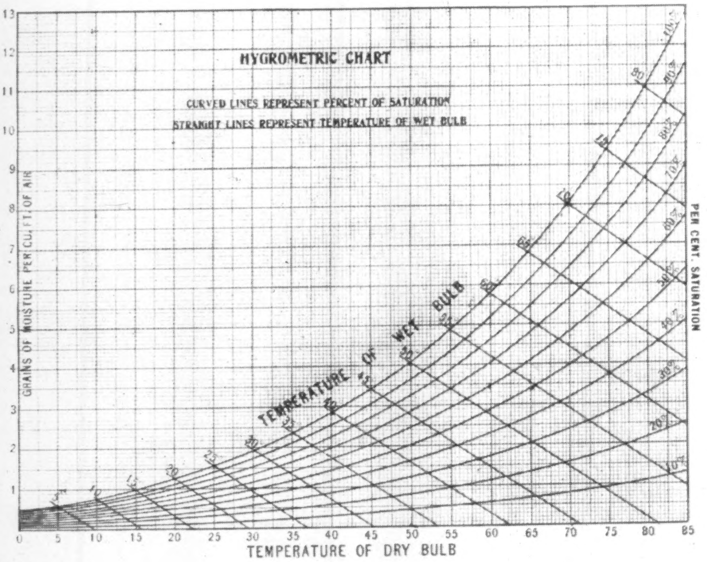
As complete proof of confidence, the contract contained a guarantee that the system would be capable of maintaining a relative humidity of 65 percent throughout all four seasons of the year.

The end of 1909 marked two significant advances in engineering routine. Humidifiers were standardized and selected from data sheets, no longer individually designed for each job. And, it is interesting to note, the data books were made small enough to be concealed in a hip pocket. Books could, in some instances, condemn the possessor as more dependent upon book knowledge than upon practical experience.

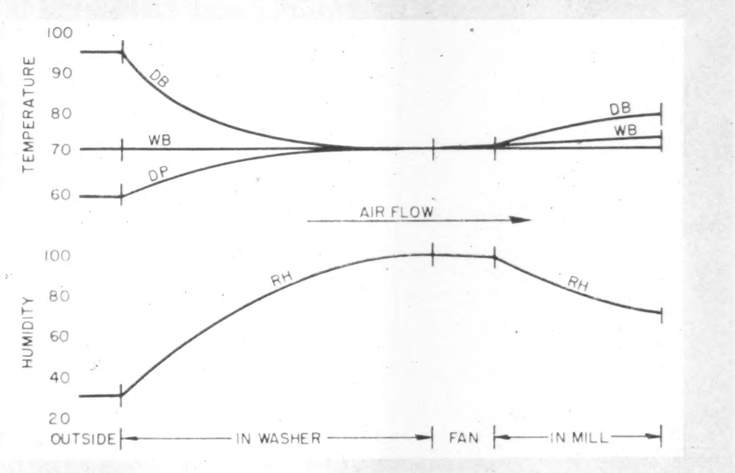
Estimating routine emerged from a few scratchings on any handy piece of paper into that of a fill-in on a printed form. The items were identical in principle with the ones now in constant use, although less comprehensive in detail. The principal items were heat gains from the sun, people, and electrical energy. Provision was made for inward transmission on northern exposures but used only for humidities of 75 percent or higher. New factors have since been added and old ones refined but both principle and procedure are still in daily use.

Prepare Hygrometric Chart

These advances served to emphasize deficiencies in both scientific knowledge and psychrometric data. Marvin's "Psychrometric Tables," reprinted by the U. S. Department of Agriculture in 1910 from stereotype plates made in 1900, were considered the best. Its 67 pages of tables provided a means "For Obtaining the Vapor Pressure, Relative Humidity, and Temperature of the Dew Point from Readings of the Wet and Dry Bulb Thermometers."



HYGROMETRIC CHART believed to have been drawn in 1904, like the 67 pages of psychrometric tables it replaced, was based upon an empirical formula derived from many simultaneous readings of dry bulb, wet bulb, and dew point temperatures



ADIABATIC HUMIDIFIER EFFICIENCY in a textile mill is shown here. As the air was washed, saturated, and diffused in the mill, effective temperature was reduced from 82 F outdoors to 76.5 F indoors

The awkwardness of this format led to the preparation of what is believed to be the first "Hygrometric Chart." The earliest record of it appears in a 1906 catalog. On it, "Curved Lines Representing Percent of Saturation," and "Straight Lines Representing Wet Bulb" were plotted against "Temperature of Dry Bulb" and "Grains of Moisture per Cu Ft of Air." In format, it and the psychrometric charts we use today are identical.

The data for both tables and chart were based upon an empirical formula deduced from many simultaneous readings of DB, WB, and dew point temperatures. Willis Carrier believed that there were errors in the form of the equation as well as in the constants employed and questioned the accuracy of both data and formula.

Develop New, Basic Formula

His response to this challenge brought a new and basic concept. "When dry air is saturated adiabatically, the temperature is reduced as the absolute humidity is increased, and the decrease of sensible heat is exactly equal to the simultaneous increase in latent heat due to evaporation." If this is true — and it is — a law can be expressed in a formula based upon the equality of the two.

This led to the development and presentation of his "Rational Psychrometric Formula" at the annual meeting of the American Society of Mechanical Engineers on December 3, 1911. Included was this significant statement: "It is the purpose of this paper to apply these final data . . . . for the solution of all problems pertaining to . . . . psychrometry and to air conditioning."

The presentation also included the first Psychrometric Chart in the basic form which is in general use throughout the world today. The outstanding addition was total heat; the outstanding change, from a cubic foot of air base to a pound of dry air base. Percentage saturation became percentage humidity. The values of total heat and absolute humidity were based on one pound of dry air.

Industrial Installations Lead

During the first two decades, the market for evaporative cooling provided most of the stimulus and most of the wherewithall for carrying on.

The improvements in practice which promptly followed the Chronicle Mill installation led to a rapidly increasing number of installations in other textile mills. Although its cost was much higher, evaporative cooling became salable largely on account of its benefits to labor. By 1920 installations had grown to such numbers that the textile field offered the major opportunity for air conditioning.

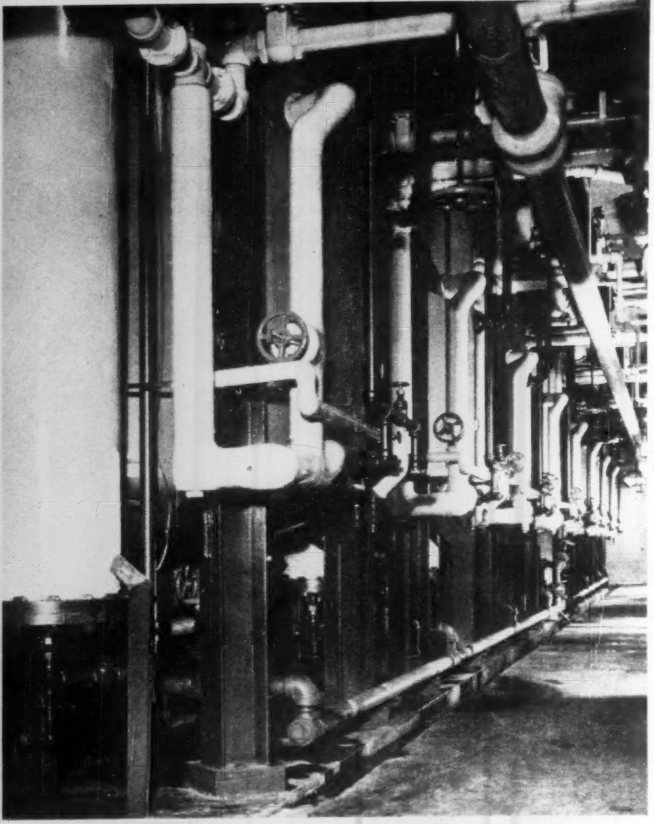
All of these textile installations were designed for evaporative cooling and the maintenance of constant humidities. No one dared to invite ridicule or worse by suggesting that, in a textile mill, refrigeration would be worthy of its cost. Not until about 1910, was refrigeration added to the evaporative cooling system, and more years were to go by before the first indications of general acceptance became evident.

During this creative era, cooling with refrigeration had been applied in certain industrial plants, hotel dining rooms, department stores, and other places. But they were relatively few in number and not relatively substantial in dollar volume. All designs, however, were based primarily upon the art and science which had been developed in evaporative cooling practice.

Theater Sets Stage for Comfort

Such was the case in Grauman's Metropolitan theater, Los Angeles, in 1921. There, industrial practice led to an overhead air distributing system which brought some ridicule at the time as the "upside down system." Its dramatic success, however, led to a rapidly increasing number of similar installations that brought the first great upsurge in the comfort field and set the stage for self-contained and small unitary systems when the first fluorinated hydrocarbon refrigerant made them possible about a decade later.

Thus, the engineering practices and the fundamentals which were derived from evaporative cooling have now become so commonplace through daily use that, to many, it may seem inconceivable that so few years have elapsed since the pioneers faced them as unknowns and eked out their solutions, often by trial and error. ⌗



Six basic factors are the keys to effective measurement of industrial piping maintenance: size of the maintenance job; size of the maintenance force; degree of maintenance efficiency; quality of maintenance; quantity of maintenance; accuracy of estimating. The author discusses each one and shows how it can be applied in achieving a more efficient plant piping system and more effective planning and control of piping maintenance.

BY ROBERT J. PINSKE

How to Measure Piping Maintenance

AT WHAT LEVEL is piping maintenance most economically performed? Many plant and maintenance engineers, as well as management executives, faced with this problem said, in a survey of 117 plants, that they would like to know what other industrial plants were doing about piping maintenance in order to compare policies and piping maintenance cost data.

The piping maintenance statistics of one industrial plant cannot be used to gage or measure the effectiveness of the piping maintenance in another plant, of course. But what figures are available might serve as an indicator for comparison.

However, only 8 percent of the plants surveyed keep accurate cost records of labor and material. Therefore, they do not know what their piping maintenance expenditures are. Equally surprising is the finding that 92 percent of the plants do not know what their piping maintenance expenditures should be.

Some plants are trying to operate their piping maintenance departments on a cost formula, yet at the same time failing to examine how much piping maintenance is required. Some managements fail to consider the very important indirect costs, such as downtime, poor product quality, and lowered output.

Visualize Total Job

Here are some of the basic factors to consider in any effort to improve the measurement of piping maintenance.

The size of the piping maintenance job varies greatly from plant to plant. In plants that have been in operation for any length of time, it is a difficult task to set up an organization that will increase operating efficiency and decrease the piping maintenance expenditures. Management must first make a complete inventory of all the physical assets.

Sixty percent of the industrial plants covered by the survey have no records of their piping and very few keep their drawings of plant piping systems up to date. The majority of the piping in industrial plants is either concealed, in large groups of piping, in inaccessible places, or poorly identified. Since it is often difficult to find pipe lines, many manhours are wasted.

The next objective is to list the requirements that are necessary to maintain all these piping assets in efficient working order. Piping sys-

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The author is sales manager, heating and industrial division, Warren Barr Supply Co.

Other recent articles by Mr. Pinske on industrial piping maintenance have been published in the November 1956 through May 1957 issues of HPAC.

tems, for example, require inspections, replacement, adjustment, cleaning, repairing, and overhauling of the various piping components, such as traps, regulators, packing boxes of valves, and expansion joints.

An analysis of this type is difficult to make and must be thorough. It can be compared to setting up a schedule of preventive piping maintenance in a new plant to assure the most economic and efficient operating condition.

Therefore, in an old plant it is necessary to add the work needed to restore it to good shape, taking the factor of repairs as well as upkeep into consideration. With adequate preventive piping maintenance, repairs and emergencies will average 10 percent or less of the total piping maintenance expenditures. This does not include new piping.

Several of the progressive managements of industrial firms contacted in this survey have used this type of preventive maintenance organization with good results for the past several years. A few of the other plants are going to reorganize the pipe fittings department because their piping maintenance expenditures are considered excessive.

An organizational plan of this type is positive proof for the plant or maintenance engineer who requires more money or additional pipe fitters to perform the required piping maintenance. In this way, top management will be able to clearly visualize the complexity of the piping maintenance function.

How to Size Maintenance Force

The size of the maintenance force is obviously based upon the accurate amount of piping maintenance required. One possible method that is successfully used in several large industrial plants is to convert each item of the work load into manhours for the pipe fitting department. Each required pipe fitting job must be analyzed down to its last component, and then work measurement standards must be applied for the various jobs. The production departments have successfully used this method for many years.

Theoretical knowledge is not adequate to organize a workable method because of the intricacies of maintenance work. Piping maintenance cannot be organized on a mass production basis. Therefore, management should know the plant engineer and the capabilities of his pipe fitting supervisors. This will help to estimate the manhours and skills needed for each job, and also the level of skilled employees working in the plant.

These methods are in partial use at the present time in the pipe fitting departments of industrial plants and operate at great varying degrees of efficiency.

These same principles may be applied to determine the size of the pipe fitting department after separating the work load into all of its components. The pipe fitting department must be of the proper size to handle the number of jobs required. A thorough plant study of this kind will reveal exactly how many pipe fitters are required and how much, if any, of the work load should be subcontracted to an outside piping contractor. This is a very economical practice followed in the majority of all plants.

Management must not fail to recognize the fact that as a plant becomes older or increases its number of working shifts, more maintenance expenditures are required.

How Efficient Is Department?

The efficiency of a piping maintenance department, in the simplest sense, is judged by the time it takes the men to do the various jobs. Assuming that product quality standards are held constant, the cost of piping maintenance will immediately begin to show a downward trend if a pipe fitter is shown an easier method to perform a job, is given new or better tools, and if the time lost looking for material can be eliminated. Good morale, as initiated by management's attitude towards the pipe fitting department, is also a large factor.

To measure the efficiency of the pipe fitters is to check their performance against the original job estimate, provided that the piping supervisor originally made the estimate. The pipe fitters should not be told the number of hours they have in which to complete a job. A report on piping maintenance budget performance does not necessarily measure efficiency, but only reveals how close the pipe fitting department has come to the expenditure goal.

The only clear measure of work is the rate of output. To measure the rate of output of a pipe fitter, it is necessary to apply the same techniques as used to measure the rate of output of a production worker. In pipe fitting maintenance, as in production, it is possible to base the time allowance on past experience, scientific work measurement, accurate estimates, and comparison with the identical work done by an outside piping contractor working on a contract basis.

How to Check Quality

The quality of pipe fitting maintenance will be disclosed by physical inspection for defects and by performance tests. The pipe fitting supervisors make up the first line of inspectors. They are responsible for observing that each piping job meets the predetermined standards.

Usually in production work there are written specifications to use as a gage for work comparison, but industry is just beginning to investigate the possibilities to develop and use standard practice instructions for each piping maintenance job. While the pipe fitters are working on a job, good supervisory inspection is the best way to assure high quality work.

Some of the larger plants have the production technique of final job inspection for all phases of their production and maintenance by having a permanent inspection corps reporting directly to the administrative branch of top management. This corps is responsible for all preventive piping maintenance inspections, as well as job conditions, and quality of performance inspections. These inspectors must be specialists in piping maintenance as they are in production. They know what to look for and what remedy is needed.

The quality of piping maintenance can be checked by various specific performance tests. One of the best clues as to the quality of piping maintenance is how well the plant is running as far as the basic piping services are concerned.

The reasons for repairing the piping equipment should be reported periodically to the plant engineer, giving a code breakdown of the reasons for every significant piping repair made in the plant. A category on wire drawing of valves, fittings, and flanges would point to the fact that proper planning or scheduling of a particular job could mean the difference between a five cent gasket and about 45 minutes labor to install it, or the alternative of a new gasket and new set of flanges, and if welded, the services of a welder plus the labor to do the mechanical installation.

For example, on a 4 in., 150 psig steam line, the approximate cost of labor and material for the above mentioned job is eight times greater when the job is deferred until the flanges become wire drawn. The piping maintenance expenditures rise rapidly when the job is put off to a later date.

Categories on corrosion and trap replacement would indicate a need for higher quality equipment or more frequent preventive maintenance. A code item such as operator abuse of air valves and hoses would place the fault where it really belongs, on production. The location of frequent repairs will usually indicate areas of poor maintenance. If adequate records are kept, an analysis of repetitive repairs will reveal any poor quality piping material, or improper selections.

On all piping equipment, one of the best methods of providing inspection is to have the production supervisors send a weekly report to the plant engineer on all visible piping defects in their departments.

The amount of piping maintenance is one of the most difficult problems confronting management today. Management is interested in knowing whether it is under maintaining, over maintaining, or just doing the right amount. The plant engineer should know the size of the job and the number of pipe fitters required to do it. If he does not, his piping supervisors should know. They should also know through practical experience if the maintenance goal is set too high or too low.

How Much Maintenance?

There is a point of diminishing return when good piping maintenance will not result in a definite return on management's investment. To locate this point of diminishing return is, of course, difficult.

A few years ago Commander R. S. Stewart, as officer in charge of naval maintenance in Pearl Harbor, Hawaii, investigated the theoretical aspect of maintenance and then applied practical experience to the problem of adequate maintenance. He set up a "casualty frequency index," to his maintenance of automotive and weight handling equipment. This analysis procedure at Pearl Harbor takes about 10 manhours a week with tabulating equipment.

The same principles can be applied to piping maintenance in industrial plants in the following manner. The index for piping maintenance can be set up to show the number of maintenance jobs per 1000 lb of steam, 1000 cu ft of air, 1000 gal of water, oil, or chemicals, or quantity of fuel per month. An index of this type reflects the number of times a particular repair is needed on a particular piece, or type, of piping equipment. It also reveals whether the type or brand of product is performing satisfactorily. The index automatically adjusts itself to actual operations, fuel consumption, or services provided to allow a fair comparison.

An index of this type may also be used to set up a preventive maintenance schedule. Piping maintenance jobs, outside the schedule, could be called nonscheduled jobs. They may be either emergency jobs required to repair breakdowns, or interim jobs to prevent breakdowns. By a careful coding of each type of job and noting the manhours on the work orders, it is then possible to develop a card record of casualty frequency indexes. This record will itemize the number of jobs, total hours, and average hours per job for these three types of jobs: scheduled, interim, and breakdown.

The cards should be analyzed each month for the relationship between scheduled and unscheduled jobs. Normally, when the ratio of unscheduled to scheduled is high, it means that a particular item is being missed at scheduled inspections. The time tables on the inspection list, to increase the frequency of inspection, must be adjusted. Conversely, if the ratio is low, it usually means overmaintenance.

The casualty frequency index is a measure of piping maintenance cost and must be watched. This index reveals to management whether piping maintenance expenditures should be increased or decreased. After a plant survey is made of all piping equipment, experience will indicate the level of piping maintenance required.

The practical approach will show a consistent reduction in piping maintenance expenditures.

Estimate Carefully

Careful estimating should be the objective of an efficient and progressive pipe fitting department. The best laid plans can go astray because of increased material costs or necessary changes. Therefore, management should not frown upon the additional expenditures, sometimes required.

Some managements have failed to realize that if they require the piping jobs to be completed in the number of estimated hours approved for a particular job, they will soon find that all piping jobs stay within the appropriations. The end results are that either piping maintenance costs increase, because of unnecessary manhours spent on the job, or the piping maintenance is deferred until later, often with disastrous results. ≠

Another article by the author on piping maintenance will be published in a future issue of HPAC.

How Government's Air Conditioning Program Is Shaping Up

To develop a better understanding of the need for and the economic values of air conditioning, 400 representatives from government and industry met in Washington recently. This government-industry symposium on air conditioning was sponsored and planned by the General Industrial Equipment Div. of the Business and Defense Services Administration of the U. S. Dept. of Commerce.

Recognizing that air conditioning is a modern necessity for all government installations in areas where it is warranted, they met with the purpose of:

1) *Pooling the knowledge of government and industry in an effort to obtain the maximum benefit of money and manpower spent on air conditioning, and*

2) *Laying the groundwork for an active program of government-industry cooperation in the study of present and future common air conditioning programs.*

Speakers included key men in both government and industry. Highlights of their talks are presented here.

A previous report of the meeting was presented in the May HPAC.

• how Defense Dept.'s air conditioning program looks

"BECAUSE of our overall responsibility, the Defense Dept. is properly interested in the complete year 'round control of the temperature, humidity, and quality of the air within structures occupied by military and civilian personnel of the armed forces," said Floyd S. Bryant, Assistant Secretary of Defense (properties and installations).

"The Dept. of Defense, in line with the trend in commercial buildings is also making extensive use of summer climate control," he said. "We estimate that the value of cooling plants and systems installed in the three military departments is not less than $200 million. The annual maintenance cost is approximately $10 million.

"As in civilian applications, much of our summer climate control is required to support functions which could not operate effectively without this modern aid. Such activities as precision machine operations, optical shops, research laboratories, underground air defense command centers, and various communication facilities must have cool, dehumidified, filtered air to carry on their functions.

"Moreover, hospitals and related medical and dental facilities of the armed forces in warmer sections of the country contain substantial areas of climate controlled space. While not all of these facilities are completely air conditioned, in many of our hospitals even general ward space is equipped with year 'round climate control. In addition to the medical requirement for cooling hospitals and clinics, we have acknowledged the humanitarian aspect and morale of the sick and convalescent.

"In the field of training the Dept. of Defense may be generally ahead of civilian counterparts in providing means of climate control," said Mr. Bryant. "Civilian schools and colleges operate on a very reduced basis, if at all, during hot weather, but those in the Dept. of Defense continue the year 'round. We believe adequate control of the atmosphere within training structures is an excellent aid to the instructional process. For instance, some mechanical and electronic training aids produce enough heat to require cooling even in winter. Then, too, we frequently must accommodate abnormal training loads, with the result that classrooms and other training facilities are often overcrowded. Climate control in these cases can be very helpful in maintaining alert responsive students.

"Since training costs in the military departments can be relatively high, it is just good common sense to do everything we can to assure maximum efficiency. Accordingly, training facilities rank high on our priority list for climate control—but I must acknowledge that a substantial majority of these facilities still don't have it."

Under the heading of military necessity, Mr. Bryant also included the work the Dept. of Defense is doing in the field of air habitability in submarines and surface ships and in high speed aircraft. "Obviously, we have some rather unusual problems in this kind of equipment," he said.

MANY GOVERNMENT BUILDINGS in Washington have year 'round air conditioning systems that were recently installed or modernized. Others are being expanded

Workable solutions are being found to these and many other air habitability problems, but there is still room for improvement, Mr. Bryant said.

"Unfortunately, the same solutions cannot be applied to both ships and aircraft," he said. For example, a number of companies are working on very compact and lightweight equipment for high speed aircraft which takes hot air out of the jet engine itself and through a number of steps—principally compression through rotors operating as high as 100,000 rpm—produces air temperatures of zero or below.

"We are always seeking to reduce weight and bulk of auxiliary equipment in ships and submarines, as in aircraft. But the high speed compressors which make possible miniaturized equipment in aircraft produce noise levels that are totally unacceptable in ships. The banshee wail of a 100,000 rpm compressor may make no difference to the pilot flying at supersonic speed, but it would present an impossible noise condition within a submarine hull—not to mention the leads it would provide to an enemy's detection devices.

The Navy, he said, is interested in ways to reduce noise and vibration as well as space and weight in all its climate control systems. "Navy specifications now call for air conditioning, as a matter of military necessity, in all ships from destroyer escort size on up. Our equipment is not as elaborate as that on commercial liners, for we are not disturbed by variations of a few degrees from one compartment to another. But it is obviously necessary, particularly as we are incorporating more heat producing equipment all the time, notably in electronic devices.

"Air conditioning has so far proved completely infeasible in the biggest heat producing areas aboard ship—the engine rooms—where we continue to rely on circulation of outside air to keep temperatures within habitable limits. But we will need a solution even to that problem before long, for we recognize the need to be able to seal surface vessels entirely for limited periods as protection against atomic, bacteriological, or chemical attack."

Mr. Bryant said the purpose of climate control in the Dept. of Defense is "solely to improve the effectiveness of the total defense effort.

"The use of climate control in areas involving equipment, processing, or other special functions is based on established engineering and other known facts. We have seen rather firm evidence, too, that climate and humidity control may increase employee efficiency in clerical duties and in similar jobs with a measurable output.

"But while we may assume that this example would carry over into other work areas, we have not yet found a way to prove that climate control enhances brain power. Does the executive, the engineer, or the scientist think better when the climate is more comfortable? If so, how much better? If we had answers to these questions, the use of climate control might be reduced to simple economics.

"Although we do not yet have enough answers to that type of question, the Dept. of Defense last year established an overall policy to guide the armed forces in planning climate control systems for new structures. We believe it is reasonable in relation to national and local trends. It allows air conditioning in geographical areas where it had not previously been authorized by the military departments. It represents the best possible balance we could presently achieve among such factors as requirements, initial and long range costs, and budgetary limitations.

"When we try to fit military housing into our policy, though, we run into some rather formidable problems. Keeping in mind that we authorize climate control only when it will improve our military effectiveness, it is clear that housing would normally be accorded a low priority.

"I suppose it could be argued that our personnel cannot work as efficiently if they have spent an uncomfortable night in hot weather, but when you have only so much money to devote to climate control, I am sure almost everyone would agree that it is more reasonable to apply our limited resources on facilities which contribute directly to defense programs.

"Unfortunately, world conditions over the past 10 years have been such that the armed forces have often had to act much more swiftly than our 2 year programming cycle allows. In the past decade we have seen World War II bases closed and reopened. Our office receives a steady stream of requests from the military departments for approval of funds to modify existing buildings for new uses. Climate control is usually a requirement; in fact, it is often the prime factor which makes the conversion feasible. The facilities are needed on short notice, which means we do not have time to go through the normal programming cycle for new construction. Therefore, other funds must be used.

"Congress authorizes us to divert maintenance and operations funds for this purpose, provided the project is urgently required in the interest of national defense. But to do so means that the maintenance and operations programs will suffer. Determining whether the building conversion is justified under that condition is only one of several decisions we must make.

"We also need to determine whether the building has a useful life consistent with the amount being invested and whether the cost of climate control will affect the number and size of necessary facilities we can provide. We may have to choose between having five usable buildings with climate control or six without it. Perhaps without climate control the buildings will be only 60 percent effective, but the remaining conversion cost will be so low that we can abandon the space after a couple of years.

"Another factor affecting our adoption of climate control is the increased cost of maintenance and its impact on our maintenance and operations budget. The construction cost is a one time problem, but maintenance is an annual expense. Naturally, then, in considering the installation cost we look at estimated overall costs for the life of the equipment and the building.

"It should be apparent that substantial benefits would result if climate control systems are designed as an integral part of new structures. Furthermore, we are interested in good, but not elaborate, design in all aspects of our structures. We need varieties of integrated climate control systems so that we will not be faced with the alternative of accepting expensive and unnecessary design features or none at all," Mr. Bryant concluded.

• *hospital air conditioning must meet changing medical conditions*

Conditions affecting air conditioning in hospitals were discussed by Richard P. Gaulin, hospital mechanical engineer, Div. of Hospital and Medical Facilities, Bureau of Medical Services, Public Health Service, Dept. of Health, Education, and Welfare.

"Great strides have been made in the last 10 years in the hospital field," he said, "both in total space constructed and in the design to accommodate the changing medical picture.

"Due to the financially lean years of the '30's and the following years of World War II, hospital construction had dwindled until in 1946 it was estimated the U. S. faced a deficit of hospital space for about 900,000 beds.

"During the period 1946 through 1955 statistics show an increase in the number of acceptable beds of 168,630. As of January 1, 1955, the need for civilian hospital beds still stood at 838,745. Despite the construction during this decade, need was reduced according to these figures by only about 60,000 beds. Thus, the present rate of construction is only slightly greater than the increasing need brought about by population increase and obsolescence.

"The past 5 years have seen an increasing trend toward air conditioning in modern hospital design. This was first noticed in the South, where today indications are that nearly all hospitals are including complete air conditioning. The trend is now noticeable in all parts of the country. In recognition of the possible benefits of air conditioning, the U. S. government, through representatives of the various interested agencies, is at present engaged in preparing regulations which will permit approval of air conditioning installations for federally owned and operated hospitals within certain climatic zones.

"Hospital and institutional construction today amounts to roughly 3 percent of the total annual construction in the country. This 3 percent of total construction plus the unmet bed need, plus replacement due to obsolescence, and the modernization potential of the thousands of hospitals which today are without air conditioning represents a respectable market for air conditioning."

Turning to the technical aspects, Mr. Gaulin said, "Temperature and humidity control are generally recognized to have definite therapeutic values in the treatment of such clinical conditions as: head injuries or operations which affect the heat regulatory center of the brain; cardiac conditions which may be adversely affected by the strain of increased blood circulation induced in an attempt to dissipate excess heat; hemorrhagic conditions which reduce the quantity of blood in circulation; thyrotoxicosis or excessive secretion of the thyroid gland which increases basal metabolism; severe burn conditions where large skin areas are damaged, reducing the evaporative cooling area; diseases of the liver and kidneys, and many diseases associated with fever. In addition, treatment of many allergies requires controlled temperatures, humidities, and air cleanliness.

"Not to be overlooked is the increasing use of hypothermia in cardiac surgery. During such surgery body temperatures are sometimes reduced as low as 83 F. Special temperature treatment through air conditioning for operating rooms where such surgery will be done will assist in maintaining the body temperature.

"Too many people today confuse air conditioning with summer cooling," he said. "In hospital work it means the simultaneous control of temperature, humidity, movement, and cleanliness of the air to provide constant optimum conditions year 'round.

"We must also bear in mind that the hospital, because of its functions and clientele served, presents many special problems for the air conditioning design engineer.

"Knowing the requirements of the various areas of the hospital, temperature and humidity control present no great difficulty. We have the necessary equipment and controls to accomplish the job, and they are being constantly improved.

"Air cleanliness and air movement are the two most difficult problems we face. We speak of air cleanliness when our ultimate goal should be air sterilization. To date we have not accomplished this in a manner that can be applied practically to the handling of large volumes of air. However, the March 1957 issue of Hospital Management contains an article, *Chemical Humidity Conditioning Found to Kill Airborne Bacteria.* The article refers to a technical report by the Research Foundation of the University of Toledo. The finding of the report is that approximately 98 percent of organisms are removed by the dehumidification process using lithium chloride. This report presents interesting possibilities and warrants careful study.

"The American Society of Heating and Air-Conditioning Engineers, in collaboration with Pennsylvania State university, is about to conduct similar research using solid sorbents."

Mr. Gaulin listed as measures which have been used for reducing the hazard of contaminated air: filtering, ventilation, sterilizing lamps, and bactericidal aerosols.

" Of these," he said, "filtering and ventilation are the most practical and most widely used in modern hospital practice. Sterilizing lamps have been used to some extent in specific areas of the hospital. Aerosols have seldom been used. For certain sensitive areas of the hospital, ventilation alone using conditioned outdoor air with no recirculation is preferred at this time."

Mr. Gaulin said the areas requiring the most careful study are: operating and delivery rooms, nurseries, patient rooms, isolation areas, recovery rooms, infectious disease and virus laboratories, autopsy, and laundry.

"Recent medical literature," he said, "contains many reports of an increase in infection of clean surgical cases. It is the opinion of many medical authorities that such infection is airborne. In view of this situation and because we have been unable to provide air sterilization, ventilation as a dilutant or medium for the removal of organisms is the generally accepted installation for operating and delivery rooms.

"The following conditions are recommended for operating, delivery, cystoscopic, and fracture rooms:

"1) Temperature from 72 to 76 F, as required by the surgeon.

"2) Relative humidity of 55 percent to reduce the hazard of static spark.

"3) Air change rate of 10 per hr.

"4) 100 percent outside conditioned air.

"5) No recirculation of operating room air during the time operating rooms are in use.

"6) A positive pressure within the operating room to prohibit the entry of air from the corridor or other unsterile areas.

"7) Exhaust air taken off from a point near the floor to remove dust and the heavy anesthetic gases.

"8) Installation to conform to that portion of National Fire Protection Association Bulletin No. 56, *Safe Practices for Hospital Operating Rooms,* which pertains to explosion hazards."

As for patient rooms, Mr. Gaulin said: "Because of the ever present possibility of cross infection, particularly of the respiratory tract and to prevent the spread of odors, it is desirable that air circulation be confined to the individual rooms. However, patient room air may be recirculated through a central conditioning system and be redistributed to the patient rooms with an acceptable degree of safety if properly filtered. A temperature of 75 F and a relative humidity of 45 to 50 percent are recommended for all rooms in this area. A minimum ventilation rate of 1½ air changes per hr is recommended for patient rooms.

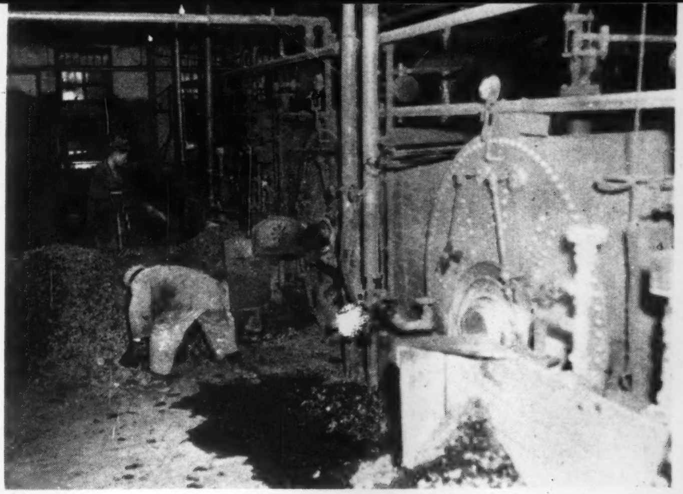
"The isolation unit," he said, "is used for contagious disease and odorous cases. Usual practice is to provide a negative pressure within the area to reduce the spread of contaminated air. The system should provide for the outward exhaust of all air. In small hospitals handling few isolation cases, a bypass for recirculation of air may be desirable. This permits more economical use of the area when not needed for isolation cases.

"Room air conditioners of the induction or aspirating type are not recommended for this area because of the necessity for periodic decontamination of the coils."

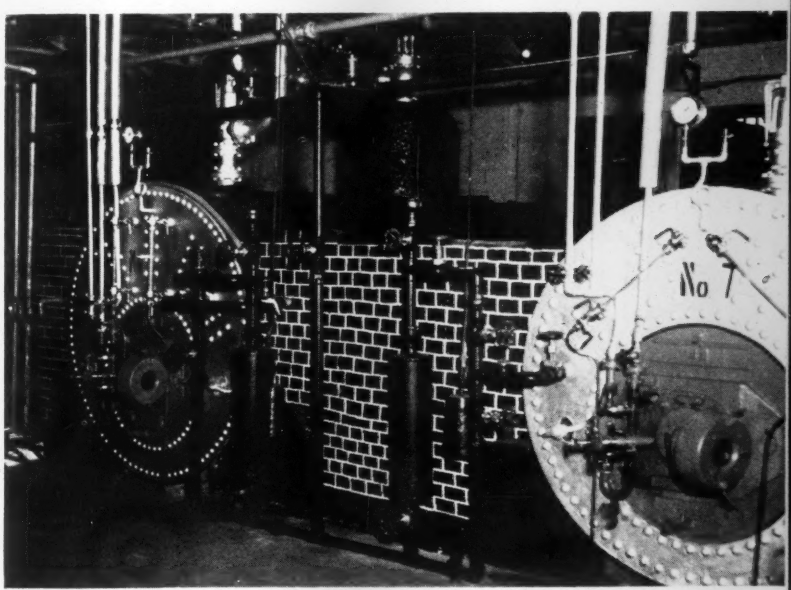
Summing up, Mr. Gaulin said: "These three areas are representative of but a few of the many areas of the complex hospital system and the problems posed by each area. Hospital air conditioning is changing as medical knowledge increases and more efficient equipment is developed."

He stressed the need for incorporating sufficient flexibility in the hospital air conditioning system, and the equipment used, to permit future adaptation to changing medical conditions. ‡

Another article on the government's air conditioning programs and problems will be published in an early issue of HPAC.



Army's Old Heating Plants



Go Modern, Efficient in Japan

Increased efficiency and economy through heating plant improvements in the last four years have cut the Army's heating bill in Japan this year to less than half of what it would have been without the improvements. First steps included installing operating controls, establishing fuel purchase standards, setting up an effective water treatment program, and training operating and maintenance personnel.

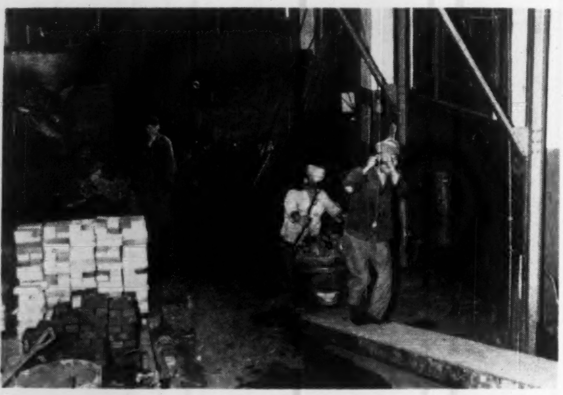
BY WILLIE HAMMER
Chief, Heating Unit-Repairs & Utilities Div.
Office of the Engineer
HQ, Army Forces, Far East

In one year, the Army spends over $150 million for utilities at camps all over the world, and heating alone accounts for more than 60 percent of this total.

After the end of the war with Japan, it became necessary to provide heat for the Occupation Forces. Except for some hospitals, few facilities taken over from the Japanese had workable heating systems. Boilers removed from wrecked buildings, factories, and from muddy storage areas were hastily installed. They were of all types, sizes, and conditions, and ranged in age from some newly manufactured to a few more than 50 years old.

Large numbers of buildings were furnished with equipment to utilize electric, gas, oil, and coal heaters, and steam and hot water radiation systems. In many in-

. . . Army's heating plant modernization program



INEFFICIENT METHODS were used in many areas of the boiler room of the Tokyo army hospital

THIS WAS the boiler room of the Tokyo army hospital prior to modernization of the heating equipment

stances, the distribution systems installed were rather peculiar technically; almost all were inefficient, and some were unworkable.

Boilers Varied In Capacity, Efficiency

At the end of 1952, there were over 400 boiler plants with more than 1000 boilers operating at pressures over 15 psig, and an undetermined number of low pressure boilers, hot water heaters, and space heaters. The cost that year to heat buildings, and to supply process steam to laundries, messhalls, and shops, and water for domestic use was over $23 million.

Boiler plants varied in capacities from 200 to 300,000 lb of steam per hr. Of all 400 boiler plants, only two had operating instruments other than pressure gages, and those two — Grant Heights and Sagamihara — were operating at efficiencies of 38 to 40 percent. It was estimated that few plants operated at efficiencies of 50 percent or higher. Of the thousand boilers, over 25 percent were hand fired, with estimated evaporation rates as low as 2.5 lb of steam per lb of coal. At some camps, plants within a few hundred feet of each other served separate systems. One camp had 10 plants with capacities of 200 to 600 bhp each, within an area approximately 1 mile square, but only an estimated 60 percent of the steam produced in these plants reached its intended point of use because of flooded steam lines, open cross-connections between steam and condensate return lines, and lack of insulation. In tunnels and pits where hot steam lines and reducing stations were flooded, water and mud boiled and bubbled. The Japanese government complained of smoke nuisances created in large cities by inefficient and badly fired plants.

Maintenance of plants and heating systems was carried out according to the abilities, energy, and desires of the heating engineers at each camp. Some camps had few facilities or trained personnel to do repair work; others were well supplied with both. At some camps, installed condensate return systems were inoperable. Large amounts of steam were lost through defective valves and traps. In almost all plants the exhaust from steam driven reciprocating feedwater pumps was wasted. Most American controls on small hot water generators were inoperative because of lack of replacement parts. Locally manufactured products were so unreliable as to necessitate the use of operators to watch automatic controls to make certain they operated properly.

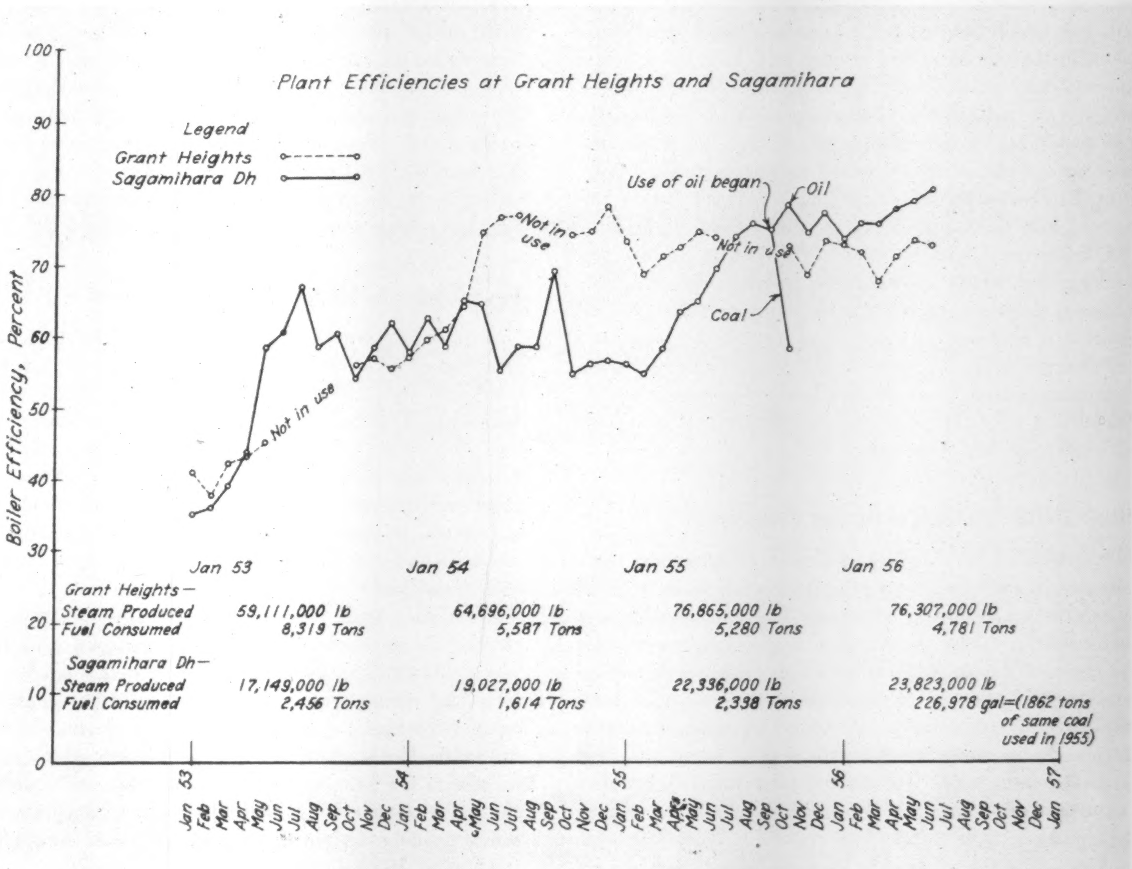
Was Difficult to Establish Accurate Costs

Coal to be used at the boiler plants was purchased in Japan with a requirement calling for a minimum of 9900 Btu per lb, but it was considered very good if it arrived at the storage yard with this heating value. Actual heating value of coal received was as low as 6800 Btu per lb. Further, storage in wet marshy areas, improper handling, and lack of means to check weights of deliveries to yards resulted in high losses of coal even before it arrived for use at the boiler plants. In some plants, diesel oil was sprayed on the coal on the grates to make it burn.

Boiler water was treated at very few installations. Those few heating engineers who attempted to do so had at that time no competent local sources from whom they could obtain necessary technical information or training. Commercial boiler compounds were purchased and fed to boilers without knowledge of what corrective treatment was required or of what the compound contained. The internal condition of boilers and distribution systems suffered; overheating and damage to metal heating surfaces due to accumulated scale was frequent, severe, and costly.

For cost accounting purposes, boilers were, and still are, rated in boiler horsepower. Ratings of boilers depended on whether they had been rated by Japanese, British, or American manufacturers, by Japanese boiler inspectors, or in accordance with Army cost accounting

has cut costs and increased overall efficiency



BOILER EFFICIENCIES increased from about 40 percent to about 70 percent in three years of modernization at two plants

methods. For example, the plant able to produce 300,000 lb of steam per hr contained Japanese and British boilers and was originally rated at 8000 hp; four Japanese boilers were rated at 1000 hp each and eight British boilers were rated at 500 hp each. The boilers were similar, neither had economizers nor air preheaters, and yet the British boilers had 6182 sq ft of heating surface compared to 5100 sq ft for the Japanese. Japanese manufacturers rate their boilers by maximum output.

Because of the lack of meters, cost accounting records necessary to determine costs of producing 1000 lb of steam were based on estimates and in almost all cases were inaccurate. Operating personnel had little interest in costs or efficiency and were interested mainly in avoiding complaints of lack of heat.

Select Heating Plants for Improvement

Headquarters Army Forces, Far East, prepares policy and operating procedures for all Army forces in the theater. The Office of the Engineer is responsible for overall technical supervision but leaves the actual operations to engineering personnel in subordinate commands. At the camps, American supervisory heating engineers consist of servicemen released from Occupation Forces in Japan to take jobs as civilians, marine engineers who prefer land jobs, stationary engineers recruited from the States, and here and there, Army personnel. Operators are local nationals with various degrees of experience and training in the operation of boiler plants and heating systems.

One difficulty with planning improvement of facilities in Japan was the uncertain lengths of retention of some of the camps. Further, reduced appropriations and shortages of funds necessitated that careful consideration be given to all expenditures. Army regulations specify that certain projects will not be undertaken if the estimated amortization period is more than 3 years. To be on the safe side, it was decided that, as a rule, available funds would be spent on projects which could be amortized in 2 years or less, and that improvements would be concentrated on facilities with longest estimated retention periods and where maximum savings could be realized.

The first step in improving operations was to make certain that operating instruments were installed. Orsat analyzers, feedwater meters, flue gas temperature meters, and draft gages were installed in boiler plants over a certain minimum size. A pamphlet was written and distributed which pointed out to operators and supervisors what instrument readings meant, and how to calculate approximate efficiencies. Operating logs were reviewed and if CO_2 readings or efficiencies were too low, or flue gas temperatures or amounts of makeup too high, the logs were returned for indicated corrective action. Army Post Engineers made certain that operations were improved and the number of returned reports reduced.

Efficiencies began to climb. The effects on the two boiler plants which had operating instruments before this program began were remarkable. At Grant Heights, an American engineer was put in charge of the plant and efficiency rose to 75 percent. At Sagamihara, Japanese engineers in charge raised the efficiency to approximately 65 percent until the plant was converted to oil, when the efficiency reached 80 percent.

Start Boiler Water Treatment Program

An effective boiler water treatment program was instituted. Qualified Japanese personnel were hired to staff a central water testing laboratory to control testing and treatment of boiler water, and simple treatment based on the use of soda ash was initiated. Camps were visited and the facilities of the laboratory used to train local personnel. Reports and boiler water treatment logs were reviewed and methods standardized. If a camp appeared to be having trouble with boiler water analysis or treatment, central laboratory personnel were sent to investigate and assist.

The amount of scale to be cleaned from boilers during summer maintenance and the number of overheated and damaged tubes and surface decreased appreciably. Unknown but undoubted savings in fuel were made because of cleaner heating surfaces. Because all camps now have personnel trained in testing procedures, more efficient treatment methods utilizing phosphates and tannins will be initiated soon. Acid cleaning of boilers has been tried successfully.

Upgrade Maintenance, Operating Procedures

The Army's excellent technical manuals were issued as guides for preventive maintenance and summer maintenance programs which were instituted on a more effective basis. Insulation was installed on lines which were bare or on which the insulation had deteriorated. Distribution system tunnels were drained and repaired where necessary. Refractory coating of firebox brickwork is being used successfully and extensively. Exhaust from steam pumps is utilized to heat feedwater. Effort is being made to obtain valves, traps, controls, and burners of more reliable manufacture.

At engineer conferences lecturers explained various phases of operation and maintenance of boiler plants and heating systems. Schools were held for Japanese personnel. Questions and answers on boiler plant operations were prepared in English and Japanese and distributed with instruction charts to be used for classroom work. The program of translating the Army's technical manuals into Japanese, which had begun after the war, was continued. The American Society of Mechanical Engineers graciously gave permission to translate into Japanese its *Rules for the Care of Power Boilers.* Instructions which had formerly been issued only in English were duplicated in Japanese. Operating logs were printed with the headings in both languages.

Set Standards, Reduce Unit Cost of Coal

A fuels engineer had been engaged in 1951 to determine what could be done about the high priced, low heating value fuel. He had recommended the system, which was adopted, of buying coal during summer months when coal prices were usually lowest. He rewrote the coal specifications and set about training qualified coal samplers employed at each receiving point. To check weights of shipments, he directed the purchase and installation of truck-weighing scales at camps receiving 3000 or more tons of coal per year.

With the Army Procurement Agency in Japan, he worked out methods of buying which would give Japanese contractors an incentive to supply higher grade coal; instituted methods of certifying laboratories to test coal samples so that payments would be made on the basis of certified coal analyses; set up methods of obtaining representative samples at the camps and of forwarding them for analyses by the laboratories; and qualified mines to make certain they could and would supply high grade coal. He inspected storage facilities to make certain coal was stocked and handled properly.

The average heating value of coal obtained in 1952 was approximately 9500 Btu per lb; and in 1955 it was almost 12,000 Btu. The average cost per ton was $11.51 in 1952 and $9.46 in 1955.

In spite of the reduction in unit cost of coal purchased, operating costs of the boiler plants were still high because of inexperienced operators, large numbers of coal and ash handlers and boilermen required, and inadequacy of equipment. In one plant of 600 hp capacity, the ashes were shoveled into a container made of half a drum, then carried up a ramp from the basement to the ash pile. In another 600 hp plant it was necessary to use a scoop at the end of a 15 ft pole to remove ashes from the dump ends of the chain grate stokers. Four or five men pushed the scoop under the stokers into the ashes at the rear, filled the scoop, withdrew it, and then flipped the pole and scoop over their heads to dump the ashes into a cart. The cart was then pushed into the yard where the ashes were dumped to wait until a truck arrived into which they were then reloaded by hand. ‡

In another article the author will discuss further the campaign to conserve fuel, the boiler inspection program, and the installation of operating instruments.

Sam Lewis' Page

Confessions of a Consulting Engineer

"To err is human, to forgive divine." Here, from the author's long successful practice as a consulting engineer, is a frank record of some heating, piping, and air conditioning design bloopers which he would take steps to avoid if he were to do the jobs over again.

It is usually not too hard to tell about the virtues of some outstanding heating, piping, and air conditioning accomplishment. But it takes a little more nerve, I find, to confess some sins committed in designing other systems which, though they may have operated through several seasons, contain bloopers.

Fortunately perhaps, we do not always hear about complaints, even though the projects may have been paid for. However, it is frequently profitable for one to consider what he would do differently if he were to do the project over again.

- At times I have failed to fight for sufficient clearances around convector units to permit latched, hinged doors to be easily opened for maintenance. One particularly embarrassing installation permits access only from underneath the unit. To clean or change the air filters, one must use a scaffold and — laboriously removing a lot of screws — lower the heavily insulated steel plate tank bottom.

- In one big air conditioning system, water is circulated year 'round in long lengths of tubing. Unfortunately, in designing this system, I failed to appreciate that a sweated type of joint in a large main which leaks cannot be repaired without draining the entire system, involving many hours and the loss of hundreds of gallons of water.

Of course, a similar leak in screwed or welded iron or steel piping might have required equal drainage to make an adequate repair, but with such materials there are usually some chances of caulking or banding in case of a leak.

- In another large installation, a long finned convector, with its small horizontal tubes, did not drain adequately, but retained enough water to eventually freeze and burst the tube.

To remedy this situation, I made provisions to blow out the water with compressed air, but even then one could not be sure that no water remained. So the answer seemed to be to circulate an antifreeze solution, and to keep the pump going. I have had the same thing — retention of water and subsequent freezing — happen with a steam heated convector in a system with leaky outside air intake dampers.

- In another plant I thought it would be economical to use the same type of finned convectors year 'round, for circulating well water in summer and recirculated heated water in winter. There was no trouble in winter, but in summer the anticipated occupancy and manufacturing heat load did not materialize.

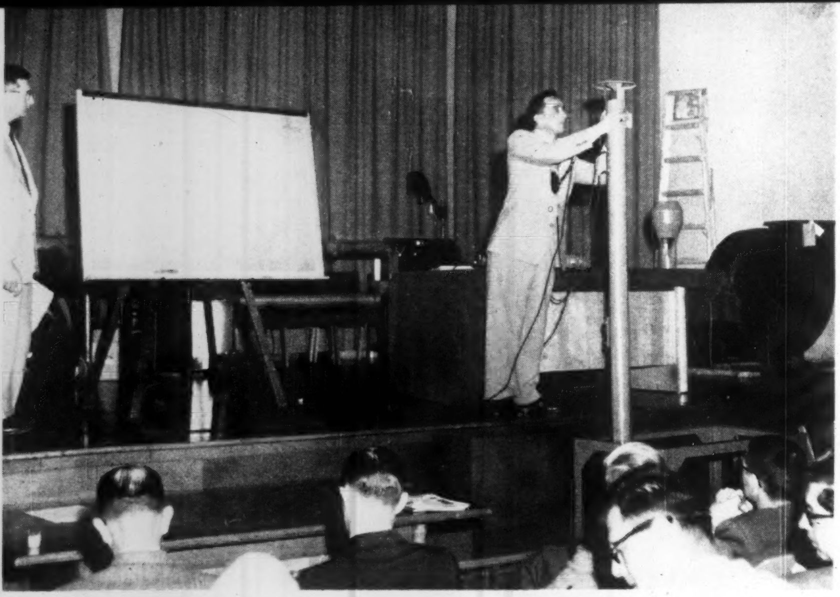
Although the bypass dampers — expected in summer to permit reheating of the cool, damp air emerging from the convectors — were opened wide, the rooms were too cold when the convectors were chilled enough to bring the air below its dew point temperature.

Some measure of correction was achieved by greatly reducing the volume of air delivered. This seems an unusual prescription in a cooling system, where the first thought usually is to increase the volume of air delivery.

If I have another chance at this project, I shall specify a separate steam or hot water reheater between each cooling convector and the room served and will not try to control humidity by bypassing uncooled air.

I have never been happy with attempts to control the volume of air delivered into the individual rooms of large buildings by manipulation of throttling dampers located only at the air supply openings. So, unless I undergo a change of heart, I cannot endorse trunk line air supply systems that have no splitters or dampers at the junctions where branches leave the main ducts. ‡

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping, and air conditioning problems.*



WEATHER CAP LOSSES were compared for various discharge assemblies as one of several demonstrations

Piecemeal Ventilation Design Days Numbered

. . . industrial ventilation conference told

BY JAMES C. BARRETT
Ventilation Engineer
Div. of Occupational Health
Michigan Dept. of Health

"THE DAYS of piece-meal ventilation design are rapidly being numbered," H. Rozovsky, consulting engineer, Toronto, Canada, told 228 ventilation engineers and contractors from 27 states and Canada at the recent 6th annual Industrial Ventilation Conference at Michigan State university.

"Exhaust volumes must be taken together with makeup air in order to provide balanced control ventilation, and the basic concepts of ventilation design must be included in the original planning," he said.

Mr. Rozovsky spoke on the ventilation engineering of asbestos milling plants. He emphasized that whenever ventilation is to be properly applied, the entire building and the process carried on within the building must be considered as part of the overall problem.

Solve Design Problems in Class

The Industrial Ventilation Conference combines a series of technical lectures and demonstrations pertaining to ventilation principles and design with classroom workshop sessions where ventilation design problems are solved. Included in the classroom sessions are informal discussion and the exchange of information between engineers.

A vital part of the program also is the open forum session which is held on one of the free nights. In this session questions are presented from engineers in attendance and the problem under discussion is open to the floor.

For the third consecutive year the program was designed for both industrial and mining ventilation engineers. The subjects considered during the 3½ day meeting were of interest to both groups. In fact, the talks were designed so that while, in some cases, specific detail related to only one field or the other, the general principles of ventilation and the method of approach were found to be equally applicable.

Need to Test Exhaust Systems

Among other speakers was Bernard Bloomfield, ventilation engineer at the Michigan Dept. of Health. He said, "The ventilation contractor and engineer must be able to test exhaust systems in order to substantiate design data and also to check the continued performance of exhaust systems."

Mr. Bloomfield demonstrated the use of standard test equipment — the pitot tube and manometer — as well as the more convenient static tap measurements, which are applicable for routine checking and reevaluation.

In this demonstration a variable speed fan was connected to about 20 ft of ductwork and an exhaust hood which was fitted with a transparent side. Various locations for static pressure readings and pitot tube locations had been provided, and Mr. Bloomfield made a series of static and velocity pressure measurements.

While values obtained for straight duct friction and elbows were consistent with design information, the resistance losses for slotted hoods apparently do not agree too well with the best design information. This indicates that there is a pressing need for basic research on the subject of ventilation design data.

Collecting Dust Underground

Jack Warren, of the Anaconda Copper Co., discussed the problems of dust control and collection in underground applications. In addition to an overall review of practices used in mines, he stressed the fact that regardless of the types of ventilation equipment being employed or the material which must be collected, the same degree of basic engineering and coordination must be applied in order to obtain maximum control and better working conditions for the man.

In mining ventilation the worker is actually living inside the ventilation ductwork. Therefore, the design problems in this field are more involved than in industrial exhaust installations.

Of special interest to mining engineers was the use of wood and concrete linings for air shafts and specific dust control measures at ore loading chutes.

Outside Makeup Air Stressed

In industry today the use of makeup air to eliminate the negative pressure in buildings and to enable exhaust systems to function more efficiently is an accepted practice. Now our attention is being drawn to other uses for this makeup air, principally towards providing comfort and relief from excessive ambient temperatures.

Speaking on ventilation for automation, K. E. Robinson of General Motors Corp. placed great emphasis on supply air ventilation using outside makeup air. The ventilation engineer, he said, is being called upon today, not only to remove toxic and nuisance materials, but also to provide acceptable or comfortable working conditions in areas of excessive heat and humidity.

The use of modern high speed machine tools together with the automated concept of bringing these tools together into heavily congested production lines has placed a tremendous heat burden on the workers in the area, he pointed out. This heat is created by the higher horsepower requirements of the tools, by the higher wattage output of lighting equipment, and all of the other contributing factors in the modern plant.

Provide Air Ceiling

The use of outside air to relieve this problem is not new, said Mr. Robinson, but the concept of "an artificial ceiling" in the plant is considerably more recent in the language of the engineer. Many plants today are finding that the outside supply air must be delivered at or below the 10 ft level in the plant, and all calculations for supply air volume, effective temperature, and the resulting humidity are based upon the so-called "living zone" of the plant below the 10 ft level.

The net result, he said, is that the supply air displaces the heated, contaminated air forcing it toward the roof where natural or power roof exhausters remove it from the building. Care must be taken to provide proper distribution through the use of diffusers or supply outlets which are readily adjustable between summer and winter operating conditions and for local problem areas.

Outside air supply ventilation is also used to provide spot cooling at many operations which were previously considered as unapproachable, Mr. Robinson pointed out.

Study Weather Cap Design

A demonstration showing the operating characteristics of exhaust systems and on weather cap losses was given by Eli Stanesa, of B & S Fabricators. In the demonstration various elbows and gooseneck fittings were placed on the stack, including the typical double cone weather cap and one of a newer design, a vertical discharge weather cap.

Resistance losses were measured for the various fittings, and it was important to note the increase in resistance caused when the cone type weather cap was placed too close to the top of the stack. Minimum static pressure loss or back pressure is experienced when the cap is approximately three-fourths to one duct diameter above the top of the stack, it was shown.

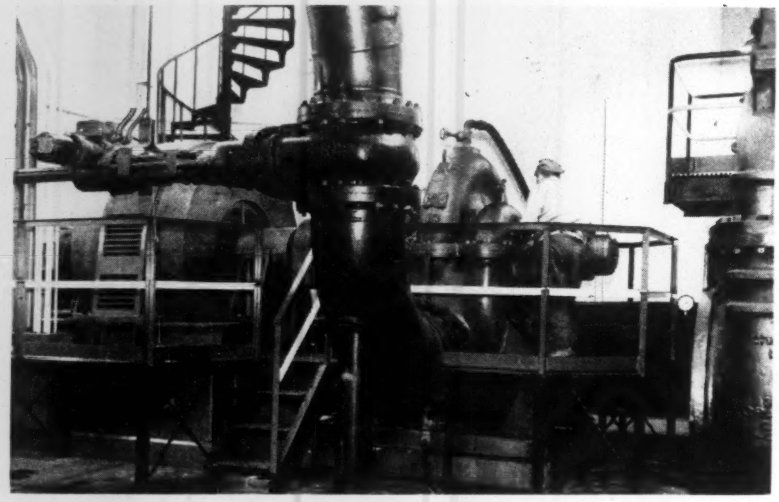
When the dispersion and dilution of exhaust gases or fumes are important, the cone type of weather cap is not successful. Smoke studies of air flow from this type of cap showed that the air discharge is downward toward the ground or the plant roof without appreciable dilution.

In many cases these conditions have resulted in overloading the plant roof with particles and with re-entry of gases or fumes back into the building through open windows or adjacent monitors. The vertical discharge type of cap has been shown to be weather proof and its use is highly recommended in order to achieve maximum dispersion of exhaust materials.

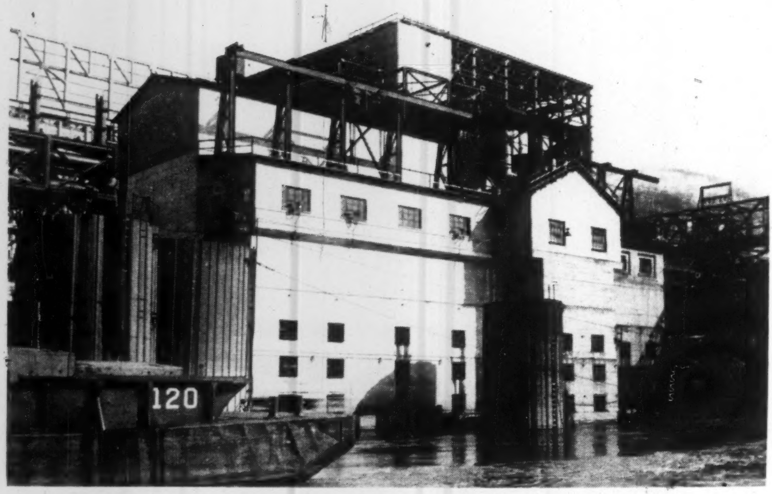
Use Spot Evaporative Cooling

The subject of makeup air was also discussed by Daniel Lindsay, of the Air and Refrigeration Corp. He dealt with the design and application of evaporative cooling equipment for industrial supply systems. As modern manufacturing standards improve, there is a continual demand for temperature and humidity control of the air that is being provided as makeup air or supply air ventilation. Contrary to the opinion of many engineers, evaporative cooling methods are definitely applicable to northern sections of the country and many successful systems have been installed, said Mr. Lindsay. In these instances the air is used primarily for spot cooling the worker at hot operations. In this case evaporatively cooled air is considered as a means for producing comfort or minimizing heat stress.

Care must be taken, he said, in using evaporatively cooled air since high rates of ventilation air must exist in the space in order to prevent undue buildup of absolute moisture content. In practice, air is delivered from the coolers at almost 100 percent humidity and is delivered through suitable diffusers or nozzles directly to the worker. Volumes up to 2000 cfm per man have been found to be effective for heat relief around furnaces and forges. The high velocity stream of cool air reduces the man's effective temperature, making him better able to avoid excessive heat buildup, Mr. Lindsay pointed out. As the air moves into the work space, the dry bulb temperature rapidly rises due to the pickup of heat, and the relative humidity drops off, he said. ⌗



30,000 Gpm Pump Ups



Capacity to 184,000 Gpm

. . . with new addition to Ohio river pumping station of Weirton Steel Co. to provide more water for its growing steel mill

BY CHARLES W. GRANACHER
Project Engineer
Contracting Div.
Dravo Corp.

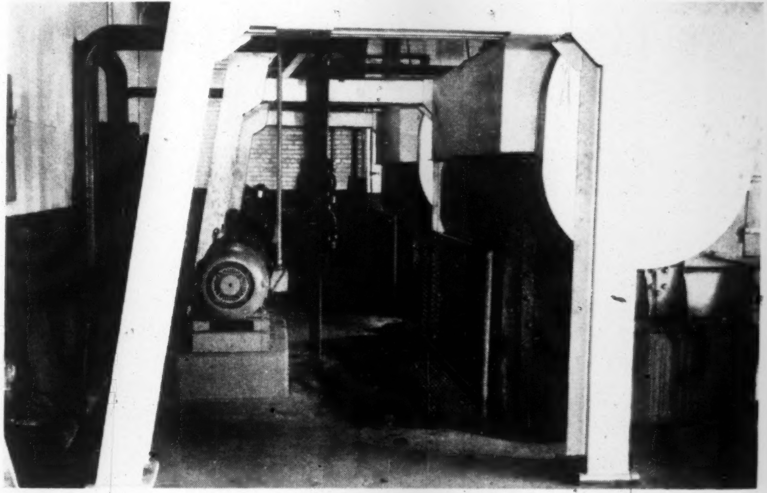
LIKE many U. S. industrial giants, Weirton Steel Co. has grown from a small beginning to its present position as a major steel producer. Originally only a rolling mill, Weirton today is a vast integrated mill operating four huge blast furnaces, as well as associated rolling and finishing operations. The company is a division of the National Steel Corp.

To keep pace with this growth over the years, the Weirton, W. Va., steel producer also has expanded its river pump house facilities which supply the mill with water.

Original Station Built in 1909

Its first pump house was built along the Ohio river in 1909. A circular masonry structure 36½ ft in diameter, it housed three 3400 gpm horizontal motor driven centrifugal pumps. Incoming water passed through two pairs of four stationary mesh screens 4½ ft wide by 24 ft high. One pair could be raised for cleaning while the other pair was in service.

As the mill expanded and need for more water developed, the original pumps were replaced with larger



TRAVELING SCREENS, 8 ft wide, in the new addition serve two of the four wet wells. The other two wells will be equipped similarly when additional pumps are installed. Pump at left is for washing screens.

units, and the pump house facility was enlarged. Today, the requirements are handled by a total of seven pumps with a combined rated capacity of 184,000 gpm.

Install More, Larger Pumps

In 1926, an addition was made to the original circular pump house on the downstream, or south, side. Three 22,000 gpm pumps were installed, along with three 8 ft wide traveling water screens. Later, one of the 22,000 gpm units was replaced by a 30,000 gpm pump. Meantime, the three 3400 gpm pumps installed originally in 1909 have been replaced several times with units of increasingly larger capacities until now this structure houses one 50,000 gpm and two 15,000 gpm pumps. Also, the original stationary mesh screens have been replaced by two modern 8 ft wide traveling water screens, which not only do a better screening job, but also allow more water to flow to the pumps now in the original circular portion of the river pump house.

Even the 154,000 gpm total capacity provided by these additions and changes proved insufficient. So last year another addition to the pump house was made. This new structure is on the upstream, or north, side of the original round pump house and is connected to it. The new addition is a masonry structure 58½ ft long by 32 ft wide, and extends from 20 ft below normal pool to 80 ft above pool.

At present, one 30,000 gpm pump is installed, but this latest addition is designed for another 30,000 gpm and a 50,000 gpm pump to take care of future requirements. The new pump is a single stage, horizontal unit, driven by a 2000 hp motor. It operates at 720 rpm and will deliver 30,000 gpm at a total dynamic head of 210 ft. The suction piping is 30 in. in diameter and the discharge is 24 in.

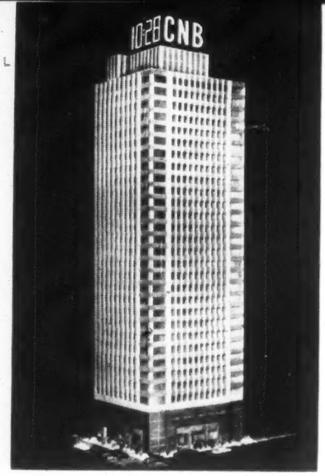
In the pump house, water is led into four wet wells through structural steel bar-screens, having 4 in. spaces between the bars. At present, two of these wells contain 8 ft wide traveling water screens with 12 gage screen cloth of No. 2 mesh (⅜ in. square openings). When future pumps are installed, additional water screens will be placed in the other two wells.

Each wet well can be unwatered when the river is at normal pool by using timber stop logs in front of the bar-screens and timber bulkheads over openings that interconnect all wells behind the traveling water screens. Normal repairs and maintenance to the traveling screens will be performed, however, by raising them out of the water with a pair of 10 ton chain hoists hung on a trolley beam supported by tall structural steel A-frames.

Although only one 30,000 gpm pump was installed during the recent expansion, suction lines for all three were built in through the wall separating the pump room and wet wells. The lines for the two smaller units terminate behind the traveling screens in flared bell mouths pointed downward. Because the intake of the 50,000 gpm unit will be on the bottom of the pump, its suction line is elbowed to extend horizontally out through the pump room wall into the wet well. The pump itself will be mounted on the floor of the structure so the suction line is in an open pit below floor level. This pit also serves as a drainage sump for the pump house.

A 42 in. diam header line runs along the front, north end, and back walls of the pump room about 34 ft above floor level. It leaves through the back wall near the old round pump house and connects to the mill supply lines. Discharge lines from pumping units connect to this header pipe.

The pump house addition was designed and constructed on a turnkey basis. It was turned over to Weirton complete and ready for service. ✢



Facing the Problems of Skyscraper Air Conditioning

With more existing commercial buildings adding air conditioning these days — and, of course, with new buildings being automatically conditioned during construction — building managers are giving increasing attention to new problems and needs in this area. Here, HPAC presents by special permission excerpts from the second annual air conditioning issue of Skyscraper Management, the official journal of the National Association of Building Owners and Managers, highlighting several important factors.

Clean Air Is Economically Important Factor, Survey Shows

CLEAN AIR is an economically important factor in a completely controlled indoor environment, write the editors of *Skyscraper Management* in the April issue of that magazine.

In a study of 624 office buildings, it was found, reported the Minneapolis-Honeywell Regulator Co., that owners spend 47.8 cents per sq ft of rentable area to keep the rental space clean enough for occupancy. This represents an industry outlay of some $210 million annually, the magazine says.

Soiled merchandise represents losses from $100,000 to $500,000 per year in leading department stores even though dust covers are placed over all goods every night.

Air Conditioning Operating Costs Rise Slightly, Buildings Report

IN ANOTHER ARTICLE, on the operating costs of air conditioning, Irwin K. Smith, of the National Association of Building Owners and Managers, reports that in the 1941 Office Building Experience Exchange Report of the National Association only 10 percent of the buildings reporting had air conditioning expense. In 1955, 30 percent had some type of air conditioning, compared with 16 percent in 1951.

Air conditioning costs in 1954 and 1955 were broken down as follows:

Item	1954 Cents per sq ft	1954 No. of buildings reporting	1955 Cents per sq ft	1955 No. of buildings reporting
Wages	6.5	70	6.0	85
Supplies	2.0	69	2.0	84
Fuel	2.5	13	3.8	19
Electricity	7.2	73	7.4	86
Water	2.0	18	3.0	33
Outside	2.3	32	1.4	43
Unclassified	0.6	20	1.2	28
TOTAL	17.2	79	17.5	98

Of the 98 buildings presently furnishing detailed information, 46 are fully air conditioned. The group as a whole average 73 percent air conditioned.

The cost of the power to operate the equipment and the water used to cool the condenser account for significant shares of this expense. Electricity averages 7.4 cents per sq ft, with water consuming another 3.0 cents. Both of these items should be metered to the system, or the building manager may discover that he is selling this tenant service below cost, warns Mr. Smith.

Sells Air Conditioning As a Merchandising Tool to Tenants

SELLING air conditioning as a merchandising tool to the tenants of the Southern Furniture Exposition building in High Point, N.C., succeeded after other approaches failed, writes Manager Leo J. Heer.

This building, totaling 12 acres in area, is used — for all practical purposes — for only four expositions a year: two weeks each in January and July, and one week in April and October. However, tenants pay rent on a year 'round basis.

Exhibit space is leased for five year terms, with leases expiring at various intervals. Leased display spaces, which average 3000 sq ft, vary greatly in heat loads because of wide differences in lighting.

The new approach was suggested by one of the few tenants enthusiastic about air conditioning. "He convinced me," says Mr. Heer, "that it was not a matter of considering the number of days air conditioning would be used, but of making conditions in the building right at the time it counted — when buyers were inspecting merchandise and placing orders."

Response to this approach was more than encouraging, he says.

The system finally chosen consists of selfcontained units from 2 to 15 tons in capacity, operating on city water in conjunction with a cooling tower.

TALLEST wholly welded steel building in the U.S. and tallest building in Fort Worth is 30-story, 385 ft high Continental National bank building, now nearing completion. Two turbo-compressors provide 1050 tons of cooling capacity for the 936 perimeter induction units and interior zones of the year 'round air conditioning system

Lease Should Be Redrawn to Include Air Conditioning Service Rights

THE LEGAL aspects of air conditioning are presented in an article by Henry Lear, of the Fidelity-Philadelphia Trust building. He writes: "The lease should be looked over when the first thought of air conditioning comes to the management or ownership of the building. If adequate provisions are not in the lease, the lease should either be redrawn to include this wording or the words inserted on any new lease drawn."

Finding its lease inadequate, the Fidelity Building Corp. revised its lease agreement to provide the necessary privileges for the installation of a central plant air conditioning system. The new lease contains this clause:

"INSPECTION, REPAIRS — (a) At all reasonable times, by itself or its duly authorized agents to enter and go upon the demised premises (i) to inspect the same and every part thereof; (ii) for the purpose, at its option, of making repairs, alterations, additions, or improvements thereto; (iii) for the purpose of making electrical wiring changes in electric service outlets in floor, ceiling and/or walls; (iv) for the purpose of making adjustments to air or water valves or dampers connected with the air conditioning system; (v) for the purpose of fighting fire within the demised premises or elsewhere in the building, or for the control or correction of conditions resulting from flood, either from a broken pipe or from outside sources; (vi) for the purpose of performing any covenants herein contained which Lessee has failed to perform; and (vii) for the purpose of remedying any matter due to breach of covenant of Lessee."

Mr. Lear also discussed relations with tenants regarding the air conditioning program.

"The installation of a central air conditioning system requires the greatest sales effort imaginable," he says. "In the first place the tenants must be convinced, before any suggestion of signing any agreement paying for the installation is broached, that they want air conditioning. They must be thoroughly conditioned to the need they have for air conditioning.

"They must be prepared also, not so much by the written word as by suggestion and verbal reminder of the "blood, sweat, and tears" that will be involved. This, in my opinion, should not be overemphasized but should be mentioned as unavoidable. While these may not seem like "legal aspects of air conditioning" it is part of the indoctrination which will be followed by legal matters, and without it the legal consummation of details will be much more difficult."

Mr. Lear states that there were three classes of tenants, legally speaking. The first were tenants who had from one to three years still remaining on an existing lease.

"The first category," he says, "would seem to have been the most difficult since there was no compulsion on the part of the tenant to accept and he could thumb his nose at us and continue to occupy his office for the balance of the term of his lease. In actual fact, however, the people in this category were, in practically every case, most amenable and signed the supplemental lease agreement with very little objection.

"The second category of tenants that had to be approached were those whose leases were expiring prior to the installation and operation of the air conditioning. These would seem to be easier to sell. But it seems to me that over the years our tenants in the building have been spoiled and expect gentle treatment from management, so that in spite of the fact that their leases were expiring, these tenants, who had no actual legal rights to resist what we were attempting, expected to be treated gently, and were. These required patience and could not be hurried to a decision.

"The third category was a small one and consisted of new tenants. These actually presented no problem at all as the new tenants knew the building was being air conditioned and the prices quoted included air conditioning, so that their rent was not being increased and they were being quoted prices which were consistent with air conditioned space elsewhere."

Regarding entering tenant premises, Mr. Lear writes: "The legal aspects of air conditioning extend way beyond the actual leases and agreements made with tenants, and in spite of the fact that in most instances the tenants had signed agreements to permit us to enter their premises and make changes before we reached that point, we insisted that the general contractors warn the tenants and get their permission to enter the premises and do specified jobs therein at specified times. This may seem like coddling but in my opinion it had a very salutary effect because it acted as a warning to the tenants that they were about to be invaded, and when the invasion occurred it did not come as a surprise.

"In this discussion I will not go into the liability of the landlord as against the contractor or subcontractor for damage or missing articles in offices of tenants. This is really a matter of insurance. But let me say from a tenant relation standpoint, it is one of the most exasperating features of the whole problem.

"We finally came to the practice of satisfying minor items by paying them out of our own pocket and then attempting to collect from insurance companies. This was done because of extreme irritation on the part of the tenants at the indifference in handling insurance claims, and I am sure that the money invested by the Building Corporation was a good investment." +

Photo courtesy York Corp.

OVERHEAD DUCTS deliver conditioned air to laboratories at National Gypsum Co.'s Buffalo, N.Y., new two story research center to simulate a range of temperature and humidity conditions

100 Ton Central System Conditions New Research Center

Over 60 perimeter units are supplied chilled or hot water in season to provide year 'round air conditioning in offices and test rooms. Conditioned ventilation air reaches all areas by ductwork above ceilings.

About two years ago the National Gypsum Co. of Buffalo, N.Y., opened its new research center. In this new building are some of the most modern facilities for scientific research and development in the U.S. It was necessary to be assured of adequate space and flexibility in its working areas to accommodate the many types of research that would be carried out in the seven major laboratories. Each of these laboratories was designed for specific work in a certain group of the company's products.

All offices in the new building are air conditioned. Laboratories too are air conditioned where control of temperature and humidity is important to the basic research conducted.

The heating and cooling system is the circulating water type, with chilled water for cooling and hot water for heating. Sixty room air conditioning units are under the windows of the two story L-shaped office area, part of which consists of laboratories. These units are manually controlled both for heating and cooling by the operation of a three speed fan motor and a manual shutoff valve in the water supply.

Ventilation for the entire area is accomplished by an air handling and conditioning unit using outside air. The air is either heated or cooled and is then distributed to the individual rooms through ductwork above the suspended ceiling to ceiling outlets.

The conference room is conditioned by a separate unit, with ductwork above the suspended ceiling.

Two 50 ton packaged water chillers connected to a two circuit evaporative condenser supply the chilled water requirements. Each refrigeration machine has a 50 percent capacity reduction, which permits cooling control in four stages. A hot water converter is automatically controlled in accordance with outdoor temperatures.

The piping is so arranged that by the operation of a three way control valve either hot or chilled water is supplied to the system, depending upon the requirements.

The boiler plant consists of an oil fired steam boiler, a 10,000 gal storage tank, and a duplex condensate pump. The boiler supplies steam to the hot water converter and also to 11 downblow unit heaters, which heat the balance of the building.

There are three insulated testing rooms in which the company conducts tests of various products. Each room is designed to maintain dry bulb temperatures from 60 F to 120 F and at the same time to maintain any selected humidity condition from a 40 F dew point to approaching saturation at any of the above dry bulb temperatures. In addition, one of these rooms is equipped with a cooling system to permit maintaining temperatures as low as −20 F.

Each room is individually controlled, with a spray type air conditioning unit, a spray water heater, a refrigeration compressor with an automatic suction pressure regulator, and electrical strip heaters for heating or reheating.

The low temperature room has a unit cooler and a refrigeration compressor.

This entire system was designed and installed by Joseph Davis, Inc., and Davis Refrigeration, Inc. — E. Weller. +

The Law and Your Profits

BY WILLIAM HURD HILLYER

Avoid Mechanic's Lien Money Traps

. . . by strictly construing the lien and making sure that every step of the transaction precisely conforms to the laws of the state

SINCE the mechanic's lien is purely statutory, it must be strictly construed to avoid money traps for heating, piping, and air conditioning contractors.

Richard Ravenous tried to foreclose a mortgage on a nearly completed building. The Sunnistate Heating Co., having filed a materialman's lien on it, entered a counterclaim. Ravenous, therefore, sought from the circuit court a final decree foreclosing his mortgage free from any claim of lien by Sunnistate.

He alleged that the mortgage had been recorded "prior to the visible commencement" of the construction. He further alleged that the owners had executed a second mortgage to Sunnistate. Ravenous asked the court to order the property sold.

Ravenous, the owners, and a supplier were named as parties defendant. The circuit court chancellor found that Sunnistate had not shown delivery, to the owner, of a sworn statement concerning payment of lienors as required by law. Sunnistate's claim of lien was pronounced invalid because it sought a lien on two plots instead of one.

Finding that the mortgage was recorded before work commenced, the chancellor decreed foreclosing mortgage clear of any lien by Sunnistate. The heating firm appealed.

The supreme court reversed the decree for two reasons:

1) Since the owner acted as his own contractor and had direct knowledge throughout of all dealings for materials, Sunnistate was not required to deliver a sworn statement.

2) Sunnistate's allegation that it furnished materials during construction, which began before the mortgage was recorded, "refuted" the chancellor's finding.

In a somewhat similar case, the Intramural Piping Co. sought to enforce a mechanic's lien on a building. The circuit court denied their claim because they had failed to serve statutory cautionary notice, and because the owners didn't know at the time they paid the contractor that Intramural had furnished him with material.

On Intramural's appeal the supreme court held that the omission to serve the notice did not, of itself, bar Intramural from enforcing their lien. However, the court said, if the owner did not obtain from the contractor a "statutory sworn statement" as to "proper payment of a person furnishing labor or materials" before making final payment to the contractor, then the owner ran the risk of having to pay twice for whatever labor or supplies the contractor had not paid for.

This decision reversed the lower court and gave the piping concern its lien.

In a third case, the contractor sued to enforce his claim and obtained judgment in the lower court for labor, the owner having agreed to furnish all materials. When the job was complete with the exception of two items not yet delivered, the contractor demanded payment in full, pointing out the delay was not his fault.

Nevertheless, the owner gave him only a small check on account and, when the items arrived, refused to let him install them, expressing dissatisfaction with the job.

The owner testified that he had made no agreement with the contractor for part of the construction but for the entire work, and that the contractor only "tinkered around" and was inactive. The lower court found in the contractor's favor. The owner appealed.

The court of appeals was convinced that the contractor and owner had "entered into a contract" and that the owner broke that contract by refusing to permit the contractor to complete the job.

However, the higher court — noting that the contractor's legal papers were "not artfully drawn" — would have awarded the contractor a judgment for the full amount if he had incorporated into the transcript of the case a record of the lien claim. The contractor having failed to submit such a transcript, the circuit court's decision was reversed and the contractor lost his case. +

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.

Piping, Valves, Pumps For Nuclear Power

. . . *discussed as first large demonstration plants in U. S. near completion*

BY KALMAN STEINER
Steiner Nuclear Services

ONE INESCAPABLE conclusion from the recent Nuclear Congress held in Philadelphia is that commercial nuclear power is very close to realization.

Another inevitably follows: just as nearly every field of science and engineering contributes to the advance of this new form of energy into everyday life, so also many firms and professions that have thus far had little or no contact with atomic energy will encounter it sooner than they think. Even the casual observer must be impressed by the progress already made by the firms engaged in developing applications of nuclear energy, representing a cross section of large, medium, and small industries.

Practically every phase of nonmilitary uses of atomic energy was covered in the technical sessions, panels, and exhibits of the congress. Coordinated by the Engineers Joint Council, the congress comprised three distinct conferences and an exposition. It was sponsored by 24 of the leading engineering and scientific societies of the U. S. and Canada, by independent groups of technologists in atomic laboratories, and the National Industrial Conference Board.

In addition to the sponsors, participating organizations included six European governmental groups, 23 U. S. government agencies, 14 universities, and the AFL-CIO.

In all, about 125 papers were presented at the 2nd Nuclear Engineering and Science Conference, and 62 more at the 5th Hot Laboratories and Equipment Conference. Nine separate discussion panels, led by 75 prominent scientists, engineers, and industrialists, made up the 5th Atomic Energy in Industry Conference. About 120 firms and organizations displayed their products or services at the 3rd International Atomic Exposition. Altogether they comprised the congress.

Some idea of the cumulative progress already achieved and of the expected rapid further development of peacetime atomic energy applications can be had by a brief look at the situation to date.

Because England placed its first commercial scale nuclear energy plant into operation during 1956, whereas Shippingport, the first American commercial plant, will not start up until late in 1957, it might seem that England has the jump on us. But while we still have adequate supplies of coal, oil and natural gas, England has not. She has been importing American coal at $22 per ton, and of course imports every barrel of oil; time does not permit deliberate development to prove which form of atomic power was the most efficient. England went ahead with the gas cycle reactor as soon as it was proved feasible. In the U.S., the Atomic Energy Commission is arranging for trial of an assortment of reactor types, hoping to find out which type will best serve our future needs.

In the U. S., aside from the submarine program which has already produced the successful *Nautilus*, there are seven demonstration plants authorized by AEC, of commercial size, representing a total of over 800,000 kw capacity and about $300 million investment of private funds, supplemented to less than 10 percent by AEC funds. In addition, many experimental and research reactors are being built.

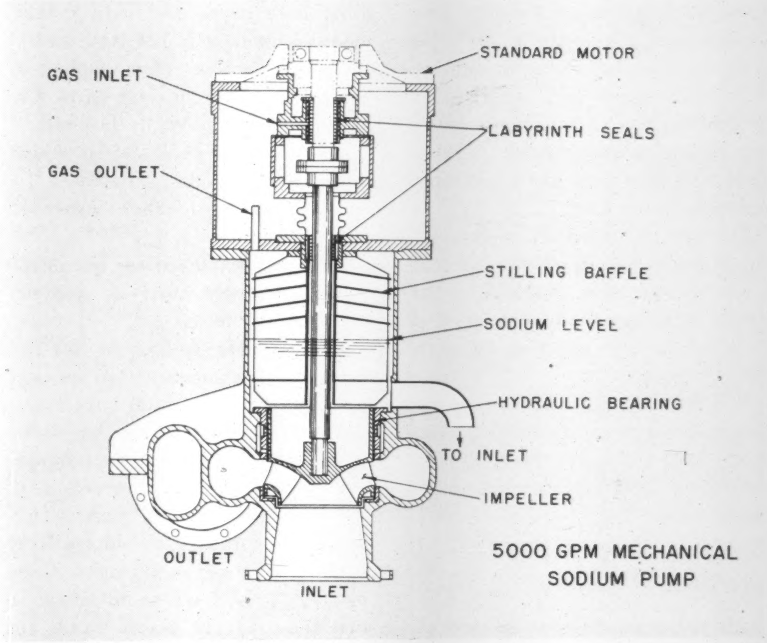
The seven demonstration plants are listed in Table 1.

By 1970 nuclear power is expected to be competitive with thermal power. Forecasts by various authorities show variation, of course, but there is agreement that by 1980 American nuclear power production capacity will be somewhere between 50 and 130 million kw, as compared to 1955 total (world) production capacity of 110 million kw. Of course, by 1980, the total production capacity will have increased to between 350 and 600 million kw.

4000 Ft of Piping in Reactor

A group of papers were devoted to reactor construction. A. J. Raymo of the General Electric Co.'s atomic power equipment department, described the containment vessel for the 180,000 kw Dresden plant. This sphere, of firebox quality steel, to contain the reactor and associated equipment, will be 190 ft in diameter. It will be fabricated of plate, starting 1¼ in. thick at the top and increasing to 1½ in. thick at the bottom, braced by 24 columns 12 in. in diameter around the middle. It is designed to withstand a wind velocity of 110 mph and an internal pressure of 29.5 psig.

Mr. Steiner, an engineer and author of many technical articles published in HPAC, is a member of HPAC's board of consulting and contributing engineers.



MECHANICAL SODIUM PUMP, single stage, has gland construction similar to that for water pump, but sealed chamber receives a supply of inert gas that is permitted to exert a pressure through the gland upon the sodium surface, preventing leakage

The vessel must have provisions for supplying and exhausting ventilating air with postive control against release of dangerous vapors, and have access openings large enough to permit transfer of large equipment items, as well as pressure locks through which personnel may enter and leave the structure without impairing its integrity.

The sphere will contain the primary loop, or radioactive components. The secondary loop is the conventional steam turbine-electric generator hookup of standard power plants using combustible fuel. At Dresden, the primary loop comprises: the reactor vessel, 14 ft in diameter by 45 ft long, weighing 300 tons; the steam separator drum, 8 ft in diameter, by 65 ft long, mounted horizontally 75 ft above the reactor and weighing 175 tons; four steam generators where primary steam generates secondary steam, each 7 ft in diam by 27 ft high, and weighing 40 tons; four 600 hp pumps weighing 15 tons each; an emergency heat sink consisting of a 30,000 gal horizontal reservoir above the primary steam drum. These components are connected by about 4000 ft of piping ranging up to 16 in. in diameter. For service, the enclosure includes a 50 ton capacity bridge crane.

Guard Against Leaks, Corrosion

J. J. Kanter, of Crane Co.'s research and development department, delivered a paper on the quality requirements for steel valves for nuclear power plants. In the primary loop the engineer is likely to encounter one of several different fluids:

- Pressurized demineralized light (ordinary) water.
- Heavy water (D_2O instead of H_2O, the D being heavy hydrogen).
- Wet saturated steam.
- Liquid sodium or alloys of sodium and potassium (at temperatures above 1500 F).
- Acid solutions of fissile materials.
- Liquid phenolics.
- Molten bismuth or sodium containing fissile materials and fission products.

Systems for safeguarding against valve stem leakage utilize special provisions beyond ordinary packing glands: bellows, canopies, labyrinths of sealing rings, or even frozen seals of the fluid itself, such as sodium. Where canopies are used, it is necessary to contrive such remote operating mechanisms as hydraulic cylinders or magnetic controls. Where bellows are used, the size becomes quite large because of need to restrict the range of movement in applications involving many cycles at high temperatures. As to packing rings of organic materials, the design must incorporate cooling means to prevent excessive temperature in the gland.

In water cooled reactors, the reactor radiation provides a constant source of dissolved oxygen, which, along with the decomposition products, causes corrosion. For these piping systems, good corrosion resistance is obtained from austenitic nickel-chromium steels, Types 347, 304, and 316. In liquid sodium heat transfer, there also exists a problem of attack upon steel, and the same steels are used.

Where liquid bismuth is the me-

TABLE 1—SEVEN DEMONSTRATION PLANTS of commercial size have been authorized by AEC. They total over 800,000 kw in capacity and about $300 million in investment of private funds, plus less than 10 percent AEC funds

Name	Type	Capacity KW	Sponsor	Completion Date
Shippingport	Pressurized water	60-100,000	AEC—Duquesne Light & Power, Westinghouse	1957
Dresden	Boiling water	180,000	Commonwealth Edison and associates	1960
Enrico Fermi	Fast breeder	100,000	AEC—Detroit Edison and associates	1959
Indian Point	Pressurized water	140,000	Consolidated Edison	1959
Yankee	Pressurized water	134,000	AEC—Yankee Atomic Electric and associates	1958
P. A. R.	Homogeneous	150,000	AEC—Pennsylvania Power & Light and associates	1962
SGR	Sodium-graphite	75,000	AEC—Consumer's Public Power of Nebraska and associates	1959

dium, there are mass transfer considerations. Constituents of the pipe metal are dissolved from the surface of the hot regions and deposited in the cool regions of the system. Here, the chromium-molybdenum ferritic steels have given the most favorable performance to date.

The organic material reactors using phenolic liquids do not present a special corrosion problem in the piping, and apparently carbon steel is a satisfactory material for such piping systems.

Perhaps the most extreme corrosion is found in the aqueous homogeneous systems, where highly resistant lining materials are still being sought.

All Piping Is Welded

All these piping systems are assembled by welding, no other method being acceptable. Choice of metals therefore rests upon welding characteristics. Though Type 347 is preferred for some installations because of stability against intergranular attack, it presents welding difficulties which are present to a lesser degree with Type 304. But the latter is more susceptible to intergranular corrosion unless special care has been given to solution heat treatment, which introduces a host of other considerations. Type 316, which is better stabilized than Type 304 and presents lesser difficulty in welding than Type 347, constitutes a middle-of-the-road choice and is being favored in some installations.

Prototypes of reactors using carbon steel components in the primary loop systems are under study. Presumably, some basis for using ferritic steels, ranging from plain carbon to the various chromium-molybdenum types, eventually will be found.

The body, bonnet, and disc components of primary loop valves must be of high integrity. The valves in that part of the system isolate the reactor and retain its fluid cover.

A proper surface for valve parts is a special requirement. Rough forged or "as cast" surface must be removed by machining, grinding, or filing both inside and out. A common requirement is 124 RMS finish, a painstaking one when applied to the inside surface of some parts. The purpose of 124 RMS is two-fold:

1) To reveal small defects which might otherwise be undisclosed by dye penetrant or other inspection means.

2) To eliminate surface irregularities which might otherwise accumulate contaminants.

Radiographic techniques for inspection of components of nuclear plant piping are of vital importance. Gamma radiography, done largely by Cobalt 60, is a convenient technique and satisfactory for most sections of the valve parts. More massive sections may require high voltage Xray or even Betatron radiography. Gamma ray "pills" have an advantage in that they may be placed inside the valve body sections, with the photographic film on the outside.

Some use has been made of ultrasonic inspection, but on the whole this technique has not reached a satisfactory state of development for application to the forms involved.

Sales volume of valves and fittings for nuclear plants is expected to reach $25 million by 1960 and $90 million by 1963, according to the Atomic Industry Forum.

Use Three Main Types of Pumps

Pumps for nuclear power plants, with capacities up to 10,000 gpm, were treated in two papers, respectively by A. F. Erwin of Allis-Chalmers Manufacturing Co. and by O. A. Seim and R. A. Jaross of the Argonne National Laboratory.

In the pressurized water and the boiling water reactors, radioactive water is pumped at high pressure and temperature, up to 2000 psig in the case of PWR. Elaborate construction is required, with respect to packing glands and packing for shafts and bearings. Impellers are arranged in stages, assembled vertically on the shaft, with a hydraulic piston bearing at the lower end of the shaft.

The packing gland at the upper end of the shaft is permitted to leak a small stream into a sealed chamber, which also receives dehydrated air from a blower. The water is drained from the chamber and returned to the system; the air is also circulated, cleaned, and dehydrated for return to the chamber. The assembly includes mechanical labyrinth type seals.

A similar type mechanical pump, single stage, has been made to pump liquid sodium. The gland construction is similar to that for the water pump, but the sealed chamber receives a supply of inert gas that is permitted to exert a pressure through the gland upon the sodium surface, preventing leakage of sodium upward.

The electromagnetic pump is also used for moving liquid metal. It is based upon Faraday's law of induction. A tube of flattened cross-section has heavy conductors passing a high current at low voltage through the liquid metal in the tube at right angles to a d-c magnetic field also passing through the liquid metal. The resulting induced force causes the liquid to move through the tube. A large capacity pump for nuclear application has been built, supplied with 250,000 amp at 2.5 v. This enormous current is conducted to the pump by means of liquid metal filled ducts to avoid electric losses at contact connections.

Still a third type of pump combines the electromagnetic and centrifugal principles by causing a rotating magnetic field to sweep through a thin walled centrifugal pump casing equipped to complete the usual electromagnetic circuit. No impellers or other moving parts are used inside the pump. Under the effect of the rotating field the liquid acquires a rotation that develops the centrifugal pressure in the conventional discharge volute.

Smaller pumps are of the so-called canned type, meaning that a more or less conventional motor driven pump has been completely encased in metal. Such pumps also employ fluid piston and radial thrust bearings, and can operate up to 1000 psig discharge pressure, moving 50 gpm. ‡

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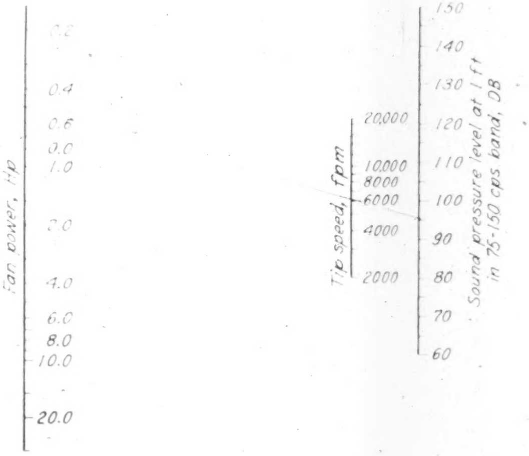
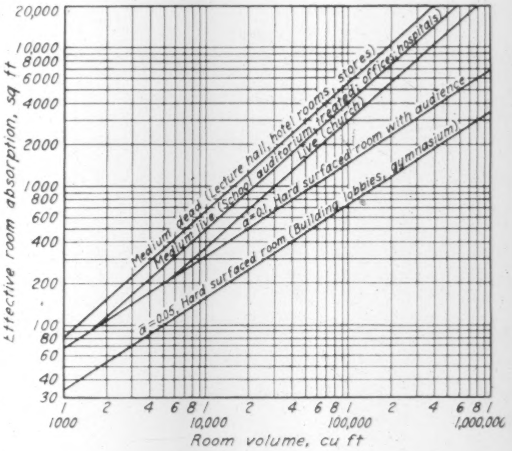


Octave Band	Amount to be subtracted from level in 75-150 cps band
75 - 150	0
150 - 300	5
300 - 600	10
600 - 1200	15
1200 - 2400	20
2400 - 4800	25
4800 - 9600	30

1 SOUND PRESSURE LEVEL at 1 ft in 75-150 cps band is calculated from fan power and tip speed



2 EFFECTIVE ABSORPTION of room according to room type is easily obtained with this chart

How to Predict Fan Noise Levels

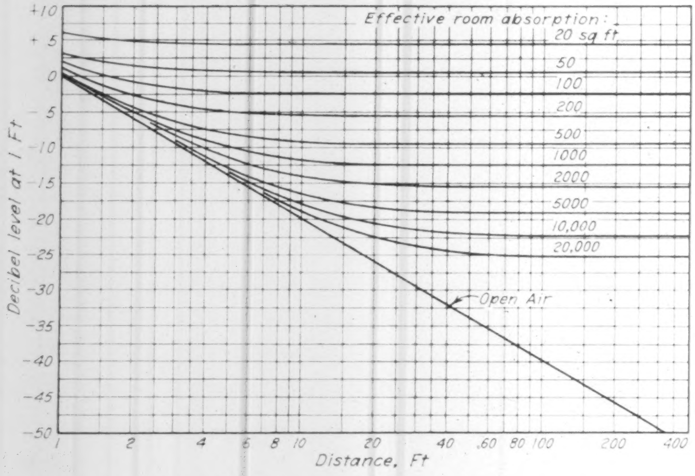
Ventilation fan noise can now be predicted from fan noise ratings, both on the inlet and outlet sides, according to the acoustics staff of the Armour Research Foundation. The new method was developed under the sponsorship of DeBothezat Fans Div. of American Machine and Metals, Inc. Presented here is a condensation of the report prepared by Armour for DeBothezat.

Soon fan noise ratings will be available in octave bands. The noise output of the fan will then be given in sound power microwatts for each band, which can be readily converted to sound pressure at 1 ft by using a nomogram.

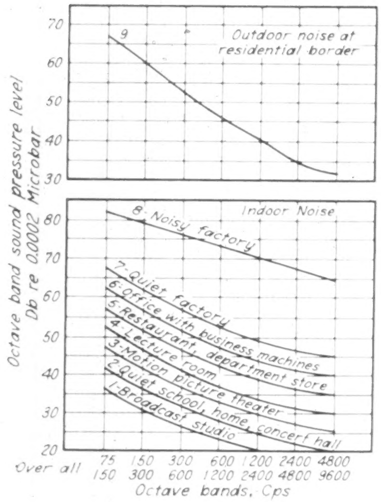
Here's how to use the nomogram — Fig. 1 — to predict fan noise. Since this is the first instance of such a procedure, the nomogram has been developed expressly for use with DeBothezat fans. By putting a point on the horsepower line at the rated horsepower and connecting this point with a line crossing the tip speed line at the blade tip speed — computed by multiplying the fan rpm by the circumference at the blade tips — and extending the line drawn, the point of crossing the sound pressure level line will indicate the approximate sound pressure level produced by the fan in the 75-150 cps octave band.

How to Find the Noise Reduction

In order to compute the sound pressure level in the room being ventilated, it is necessary to know the sound characteristics of the room. There will be more noise in



3 NOISE REDUCTION in rooms decreases with distance from fan or duct opening according to effective absorption



4 ACCEPTABLE NOISE LEVELS for different spaces are shown here

most rooms close to the fan or its duct opening than at more distant regions due to sound attenuation with distance. There will also be a difference in sound level at points remote from the fan or its duct outlet which depends on the amount of absorption in the room.

Here's how to find reduction in noise at points within the room not close to the fan.

1) Determine which of the room types shown on the sloping lines in Fig. 2 most nearly fits the room conditions.

2) Obtain the effective absorption of the room from Fig. 2.

The effective absorption found can be used with Fig. 3 to determine the noise reduction due to the room characteristics. The curves show how the noise level decreases with distance from the fan or duct opening for values of effective room absorption. Since we are usually only interested in noise levels away from the fan, the straight horizontal lines of the curves should be used. If people will be close to the fan, it will be necessary to use the actual distance between the people and the fan or duct outlet to find the noise reduction.

How Much Fan Noise Is Permissible?

Using Fig. 4, determine the type of room which is most nearly like the type of room under consideration. The curve having this number shows the maximum permissible fan noise in the room. Subtract the acceptable levels in octave bands from the levels expected within the room under consideration. The resultant set of numbers will be the reduction in noise level required in order that the fan selected be acceptable for the room being ventilated. If these numbers are negative, then no quieting will be required. If positive, they indicate the number of decibels in each octave band which must be eliminated.

To simplify the method for calculating the expected noise levels and the expected noise reduction, a work sheet, shown in Fig. 5, is convenient for recording all the required information.

For example, suppose we want to predict the fan noise which will be present in a factory office. The office is 30 × 20 × 10 ft and requires 1400 cfm of air. It is to be ventilated by a single exhaust fan.

The fan selected for this application has a rating of 1/6 hp and a tip speed of 3420 fpm. Since the noise rating of this fan has not been specified, it will be necessary to estimate the fan noise from Fig. 1. Drawing a line through 1/6 hp and 3420 fpm shows that the fan should have an estimated sound pressure level in the 75-150 cps band of 77 db.

By using the table at the bottom of Fig. 1, the sound pressure levels have been entered in Step 2 of Fig. 5.

Next, the dimensions and vol-

Tear out along this line

CALCULATION OF NOISE PRODUCED BY VENTILATING SYSTEMS

EXAMPLE OF FAN NOISE CALCULATION FOR A FACTORY OFFICE

No. of fans 1 Fan Hp $\frac{1}{6}$ Tip speed 3420 Cfm per fan 1400	Total fans inlet sound power microwatts	Fan inlet sound pressure level at 1 ft, from Fig. 1	Reduction due to room absorption and distance, From Fig. 3	Expected fan noise level in room, Step 2 – Step 5	Maximum permissible fan noise in room, From Fig. 4	Noise reduction required, Step 6 – Step 7	Duct branching Reduction, From Step 9	Noise reduction to be added, Step 8 – Step 10
Step	1	2	5	6	7	8	10	11
75 – 150 Cps		77	6	71	63	8	0	8
150 – 300 Cps		72	6	66	57	9	0	9
300 – 600 Cps		67	6	61	52	9	0	9
600 – 1200 Cps		62	6	56	47	9	0	9
1200 – 2400 Cps		57	6	51	44	7	0	7
2400 – 4800 Cps		52	6	46	42	4	0	4
4800 – 9600 Cps		47	6	41	40	1	0	1

3. Room volume, L X W X H = Cu Ft
30 X 20 X 10 = 6000

9. Duct system between fan and room
percent fan air reaching room 100, reduction 0

4. Room use Factory office Room rating 6 From Fig. 4
Room type Hard wall/audience Room absorption 230 From Fig. 2

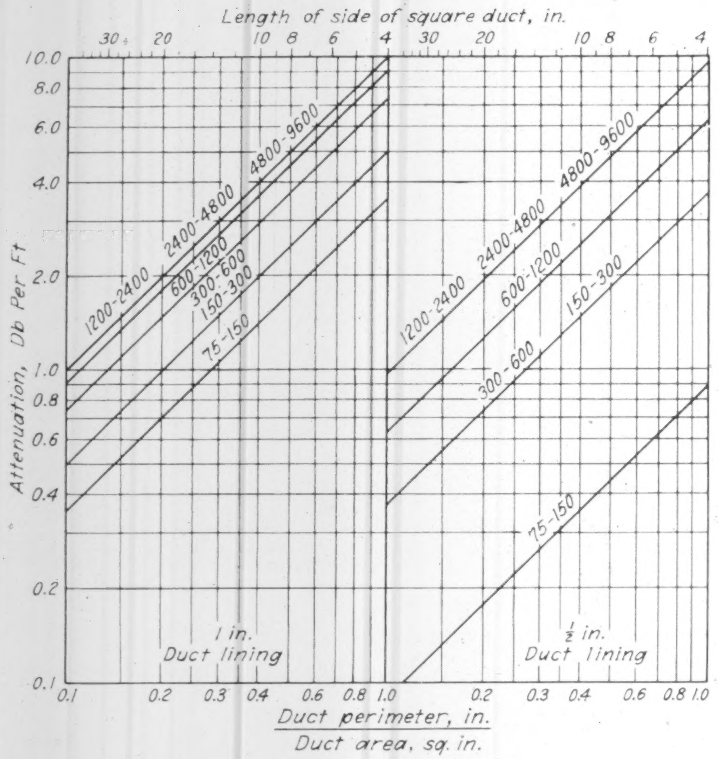
	Outdoor noise prediction						Plenums			Lined ducts				
	Fan outlet sound power microwatts	From Fig. 1 Sound pressure level at 1 ft.	From Fig. 3 Reduction due to distance	Step 12 – Step 14 Level at nearest residence	From Curve 9 - Fig. 4 Desired level at residence	Step 15 – Step 16 Required reduction	Noise reduction to be added Same as Step 11	From Step 18 Noise reduction from plenum	Step 19 – Step 20 Added Reduction needed	Same as Step 19 Noise reduction to be added	From Step 23 Reduction, Db per ft	22 Divided by 24 Required feet of lined duct	Reduction using 3.8 foot duct	Step 6 – Step 10 – Step 26 Expected fan noise in room
Steps	1	12	14	15	16	17	19	20	21	22	24	25	26	27
75 – 150 Cps		77	29	48	67	—				8	2.1	3.8	8	63
150 – 300 Cps		72	29	43	60	—				9	3	.3	11	55
300 – 600 Cps		67	29	38	52	—				9	4.4	2.1	17	44
600 – 1200 Cps		62	29	33	46	—				9	5.4	1.7	20	36
1200 – 2400 Cps		57	29	28	40	—				7	6	1.2	23	28
2400 – 4800 Cps		52	29	23	35	—				4	6	.7	23	23
4800 – 9600 Cps		47	29	18	31	—				1	6	.2	23	18

13. Distance from fan to nearest residential boundary 30'
Use Fig. 5 to get Step 14

18. Duct size – ___"X ___" Outside
Area ___ sq in.
Wall area of plenum or room ___
Size of plenum ___'X ___'X ___'
Use Fig. 8 to get Step 20

23. Lined duct –
Size = 22"X 4" Inside
24"X 6" Outside
Perimeter = 52" inside
Area = 88 sq in. inside
$\frac{\text{Perimeter}}{\text{Area}} = 0.59$
Use Fig 7 to get Step 23

5 WORK SHEET conveniently records all required information and simplifies calculation of expected noise levels and expected noise reduction



6 SOUND ATTENUATIONS in decibels per ft are shown here for various duct sizes and linings

ume of the room are entered in Step 3.

The factory office would normally be considered a hard wall room with an audience. This should be entered in Step 4. From Fig. 2 it is found that a hard surfaced room with audience, with a volume of 6000 cu ft, will have an effective absorption of 230 sq ft.

From Fig. 3 it can be determined that a room with an effective absorption of 230 sq ft will have a noise reduction of approximately 6 db because of the characteristics of the room. This is entered in Step 5 of the sheet. By subtracting Step 5 from Step 2 the expected fan noise levels in the room are listed in Step 6. This then is the noise which the fan will produce in the factory office without any quieting.

Next, find the permissible noise levels in a room of this type, as shown in Fig. 4. The table in Fig. 4 indicates that a factory office should have a noise spectrum like that shown in Curve 6, which gives the values for permissible noise in the various octave bands as listed in Step 7 of Fig. 5.

Find Noise Reduction Needed To Make Fan Acceptable

Subtracting Step 7 from Step 6 gives the values of noise reduction required to make the fan acceptable in a room being ventilated. These are listed in Step 8 of Fig. 5.

Since all of the air produced by this ventilating fan is used to ventilate one factory office, there will be no noise reduction due to duct branching. Therefore, Step 9 should show that 100 percent of the air reaches the room being ventilated and there is no noise reduction obtained. Step 11 will, therefore, have the same values as Step 8.

Since the noise reduction required is slight, it can probably be obtained economically by the use of a short section of lined duct.

It will be necessary to design a lined duct which will have an inside area of 88 sq in. and an inside perimeter of 52 in. To conform to this, the 24 × 7 in. duct may be lined with 1 in. acoustical material. The inside and outside dimensions of the lined duct, as well as the perimeter and area, should be entered in Step 23 of Fig. 5. The perimeter/area ratio of this duct will be 0.59.

Using Fig. 6, the sound attenuations in decibels per foot for a duct of this size lined with 1 in. acoustical material are entered in Step 24.

Dividing Step 22, which lists the noise reductions required, by Step 24 gives the lengths of lined duct required for each octave band as listed in Step 25.

By using 3.8 ft of lined duct the attenuations obtained in each octave band are listed in Step 26. These values were obtained by multiplying 3.8 by the number of decibels per foot in each octave band. By subtracting Step 10 and Step 26 from Step 6, the noise levels for the room are listed in Step 27. These levels are equal to or less than those required in the room. Therefore, the fan installation is satisfactory with 3.8 ft of lined duct added. ⌗

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

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Heating, Piping & Air Conditioning

Journal Section

of the

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

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SOCIETY COMMITTEE ORGANIZATION

General Committees: The By-Laws provide for 9 such committees. The listing appears in the May 1957 issue on page 174

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research appoints Technical Advisory Committees as needed. Latest list, with current membership, appears in this issue on page 182

Special Committees: At present there are 9 of these committees. The list of them and of their personnel can be found in the May 1957 issue on page 174

Nominating Committee: This committee's membership is fixed by the By-Laws. The listing appears in the May 1957 issue on page 174

SOCIETY REGIONAL ORGANIZATION

The latest listing of the names of the Regional Directors and of the members of the Chapters Regional Committees appears in the April 1957 issue on page 176

SOCIETY CHAPTERS AND BRANCHES

The Society has chartered 67 Chapters, 1 Special Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in the February JOURNAL on pages .. 267-68

The President's Page

How the Regional Meetings Are Going

THIS page is being written while I am in transit to the regional meetings at New Orleans, Los Angeles, Tulsa and Kansas City, and I am looking forward with great pleasure to visiting with the chapter representatives attending these meetings. During March, I attended similar meetings at Detroit, Ottawa, and Albany and my experiences were interesting and enjoyable. Traveling through this country and into Canada, and being so graciously received, meeting so many old friends and so many new ones, are some of the pleasurable activities of this office of President of the Society.

The pattern varied at each of these three meetings. Improvements suggested at one meeting were used at the next with a resulting improvement in the effectiveness of each successive meeting. These experiences through these successive meetings will also provide the Regions Central Committee with valuable information on how to plan still better meetings for next year.

All of the subjects discussed at these regional meetings are referred for future development to the Regions Central Committee as a part of the 1957 Chapters Agenda. However, several subjects are of sufficient news interest to warrant review on this page.

First, there is a desire on the part of the chapters for a more definitive statement of policy setting forth the extent and the nature of cooperation permitted a chapter in working with local codemaking agencies. In the past, many chapters have interpreted the instructions regarding *influencing or intending to influence legislation* in its strictest terms, — a restriction against assisting by furnishing technical advice to government agencies developing rules or codes concerning HVAC work. Some of the chapters stated that they believe we could not properly discharge our responsibilities as the technical society concerned with the arts and sciences of HVAC unless some cooperation with rule- or code-making local agencies is permitted. What, therefore, is necessary is a complete study of this problem by the Council and our legal counsel, with a statement that will clearly set forth the activities that are permitted, the activities that are not permitted, and the extent of the guidance or supervision that is necessary.

Second, and along the same lines, it was suggested that the Society initiate a project to rationalize information on the ventilation requirements of grade school and high school buildings. It was pointed out that existing state codes for classroom heating and ventilating vary greatly, — particularly as to the quantity of fresh air required. If and when school boards look to the Society for advice on this subject, they should be provided with the most up-to-date information that is available.

The third question concerned the subject of what is new regarding cooperation between *ASRE* and ASHAE. Many of the chapter representatives indicated a strong interest in the direction of closer cooperation between the two Societies. The Society officers present at these meetings highlighted the many problems facing the Joint Committee of the two societies and the need for considerable study before being in a position to state a policy.

Many other interesting items were discussed at the first three meetings, and I am sure many more will develop through the next four meetings of the Chapters Regional Committees.

P. B. Gordon

President

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Thermal Performance of Frame Walls

Part III — Wall Surface Temperatures

By G. O. Handegord*, Saskatoon, Canada

Selection of insulation for use in frame walls under cold weather conditions is often based solely on the calculated overall thermal properties of the resultant wall section. This approach may be adequate from the standpoint of heating system design or interior comfort evaluation where overall average values are involved. However, it may not always provide an accurate appraisal of wall performance in regard to such problems as surface condensation or dust marking.

Two previous papers[1,2] demonstrated that actual surface temperature patterns exhibited by frame walls may differ widely from those predicted on the basis of simple theory. Both papers emphasized the vertical variations in temperature caused by convective action in the wall space. The second paper[2] provided some additional information on horizontal surface temperature variations resulting from lateral heat exchange at studding. It was suggested that the surface temperature gradient in the vicinity of studding was largely influenced by the arrangement of insulation in the stud space and by the degree of thermal protection afforded the sides of the stud.

The amount by which surface temperatures over studs are lower than surface temperatures between studs may be important in connection with the possible occurrence of condensation on the inside surfaces of insulated frame walls. The studies of vertical temperature variations referred to above have shown that, at low outside temperatures, inside surface temperatures near the bottom of such walls may be lowered to the point where condensation is imminent even at moderate relative humidity. For this reason, it may be desirable to select insulation arrangements that lead to the highest possible surface temperatures over studs.

SUMMARY — Horizontal surface temperature patterns resulting from the effects of studding for a number of frame wall constructions have been investigated. The relationship of surface temperature to lateral heat flow within frame walls and design considerations related to this are discussed. Information is also provided to assist in the prediction of surface temperatures of frame walls in which semi-thick batt or blanket insulation is installed.

Steep surface temperature gradients will normally result in *dust marking*. This phenomenon, discussed in detail by Nielsen[3], is due to differences in the rate of accumulation on surfaces at different temperatures. The seriousness of the problem is dependent upon the period necessary for a noticeable pattern to appear and the relationship of this period to the normal redecoration schedule. Walls that exhibit severe temperature gradients in the vicinity of studding will require a shorter period of time for noticeable patterns to form and it is therefore desirable to select and locate insulations within the wall to provide the most uniform surface temperatures possible.

The study reported in this paper was undertaken to obtain more complete information on the horizontal surface temperature patterns resulting from the use of different types and arrangements of insulation in a conventional frame wall. Consideration was given to suitable methods for prediction of surface temperature patterns on frame walls with particular emphasis on walls with semi-thick batt or blanket insulation. The project was undertaken as part of a program on Cold Weather Wall Research at the Prairie Regional Station of the Division of Building Research, National Research Council of Canada, at Saskatoon.

Test Apparatus

The test apparatus has been described previously[1]. It consists basically of a cold-room — warm-room combination in which a full-scale frame panel can be subjected to a temperature gradient under controlled conditions. Regulation of air temperature on either side of the panel was within ±½ F. Forced circulation of air was maintained upward over the cold face of the panel during all tests; gravity circulation was employed in the warm room.

All temperature measurements were carried out with 30 B & S gage, copper-constantan thermocouples in conjunction with an electronic indicating potentiometer. Surface thermocouples were cemented in grooves so as to be flush with the wall surface. At least 2 in. of the lead wire from the thermojunction was similarly secured to the wall. Thermocouples were located at points midway between studding, on the centerline of the stud, and 2 in. from the stud centerline at 3 vertical positions on the wall section. Additional thermo-

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*Research Officer, Division of Building Research, National Research Council of Canada. Associate Member of ASHAE.

[1]Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 1957.

couples were installed at various locations throughout the wall.

Heat meters were used in most of the tests to determine rates of heat flow into areas over the stud and midway between studding. These meters were of the multiple differential thermocouple type, with the sensitive elements mounted between synthetic resin sheets 4½ in. square. Each meter was held against the wall surface by 4 spring-loaded polystyrene rods which extended from a carriage that could be moved vertically up the wall. The emf generated by the thermopile was recorded for a period of at least 1 hr at each location using an electronic strip chart potentiometer.

A third heat meter was used in one of the tests to provide a measure of the rate of heat flow into the center of the sheathing at mid-height. This meter was secured to the warm face of the sheathing with ¼ in. No. 6 wood screws.

Test Procedure

The same basic wall panel, 8 ft in height by 5 standard stud spaces in width, was used for all tests. The two outer stud spaces were insulated with mineral wool insulation and were left unchanged during all studies. The different types of insulation tested were installed in the three inner spaces, but all measurements were confined to the center space.

Modifications to the insulation of the test panel were made prior to weekends with the subsequent test period being of 3 to 4 days duration the following week. Four complete temperature traverses, and 2 complete heat meter traverses were made during this time.

Description of Walls Tested

The basic wall panel consisted of 6- by ½-in. bevel cedar siding as exterior finish, sheathing paper, 25/32- × 10-in. spruce shiplap sheathing, 2- × 4-in. framing (actual dimensions 1½ × 3½ in.) and ⅜-in. gypsum wallboard. The gypsum wallboard was secured to the framing with 1-in. No. 12 wood screws so that it could be removed to change the insulation.

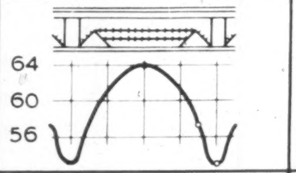
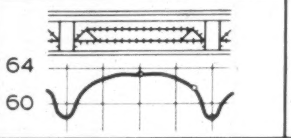
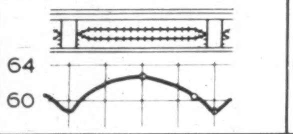
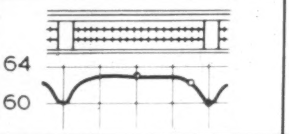
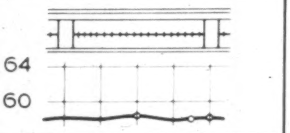
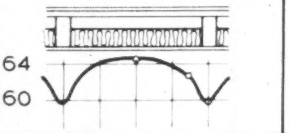
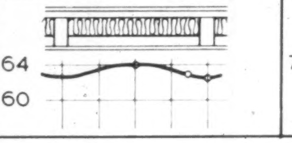
1	2	3	4	5	6	7	8
WALL NO.	TEMPERATURE PATTERN	T_i	$T_i - T_o$	ΔT	$\frac{Q_{st}}{Q_{ss}}$	ΔT	$\frac{Q_{st}}{Q_{ss}}$
① FOIL BLANKET		70.2	100.1	11.1	2.7	2.4	1.4
② FOIL BLANKET		70.2	99.9	4.9	1.5	2.4	1.4
③ FOIL BLANKET		69.9	100.0	4.0	1.6	2.4	1.4
④ TWO FOIL CURTAINS		69.9	99.9	2.8	1.5	2.4	1.4
⑤ ONE FOIL CURTAIN		70.7	104.8	0	–	0.5	1.1
⑥ TWO INCH BATT		70.4	100.4	4.9	1.7	2.8	1.5
⑦ TWO INCH BATT		70.4	100.4	1.5	1.1	2.7	1.5

Fig. 1 — Surface temperatures on frame walls with different types and arrangements of insulations

Twenty-six different insulation arrangements were tested involving both reflective and mineral wool types. Six forms of commercial house insulation were studied and these were applied as carefully as possible according to the manufacturers' directions. The commercial insulations studied are best illustrated by the horizontal sections shown in Fig. 1. For further tests on insulation fit at the stud, a preformed low-density glass fiberboard-type insulation was cemented to the cold side face of the plasterboard and cut to accommodate the framing. The insulation and plasterboard were then removed as a unit and the insulation edges recut to the required shape at the studding for each succeeding test.

Discussion of Results

Relative Performance of Different Insulations: Fig. 1 provides a summary of the results obtained on 11 wall constructions having different types and arrangements of insulation. The values listed represent the average of measurements taken at the 2-, 4-, and 6-ft levels on each wall. Column 2 shows the cross-sectional details of each panel together with the associated horizontal surface temperature pattern. The plotted curves are based on readings taken over one-half the stud space width. Symmetry has been assumed in extending the curve for the width shown.

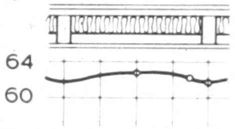
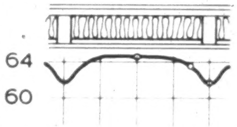
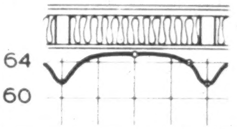
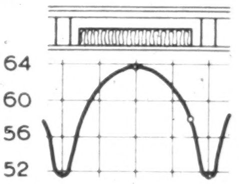
1 WALL NO.	2 TEMPERATURE PATTERN	3 T_i	4 $T_i - T_o$	5 ΔT	6 $\frac{Q_{st}}{Q_{ss}}$	7 ΔT	8 $\frac{Q_{st}}{Q_{ss}}$
⑧ TWO INCH BOARD		69.5	98.9	1.1	1.1	2.7	1.5
⑨ THREE INCH BOARD		69.8	98.3	3.1	1.7	4.0	2.0
⑩ ROCK WOOL FILL		69.9	100.3	4.0	1.8	4.3	2.1
⑪ TWO INCH BOARD		69.5	99.6	12.0	3.5	2.8	1.5

Fig. 1 ***(continued)*** **— Surface temperatures on frame walls with different types and arrangements of insulations**

All panels were tested under similar conditions with warm-side air temperatures at approximately 70 F and cold-side air temperatures at approximately −30 F. The warm-side air temperatures are listed for each wall construction in Column 3 and the inside-to-outside air temperature difference is shown in Column 4. The greatest departure from the test conditions occurred for walls Nos. 5 and 9, where the inside-to-outside air temperature differences were 104.8 F and 98.3 F, respectively. The average differences in surface temperature between studding and over the stud are listed in Column 5 and the ratio between the rate of heat flow into the area over studding to that midway between studs is shown in Column 6.

Wall No. 5, in which the insulation consisted of 2 air spaces each faced one side with foil had the most uniform wall surface temperature pattern of any of the walls tested. This wall represents a case where the thermal resistance of the portion between studding is similar to that at the studs, and a close approximation to a thermally homogeneous wall results. In regions of severe winter climate, however, the thermal resistance provided by such a wall construction is inadequate from the economic standpoint and is substandard in regard to optimum interior comfort.

Of the walls in which reflective insulation was used wall No. 1 showed the greatest horizontal variation in surface temperature. In this wall the insulation provided in the stud space was basically 3 air spaces, 2 faced 1 side and 1 faced 2 sides with aluminum foil. In this respect, the insulation was equivalent to that in walls Nos. 2, 3, and 4, but these walls showed less severe variations in surface temperature.

Examination of the cross-sectional details for these 4 walls shows that this improvement in surface temperature pattern is at least partially associated with the degree of exposure of the sides of the studding. In wall No. 1 the stud was exposed to the cold outer air space for its entire depth; in wall No. 2, for two-thirds of its depth; in wall No. 3, for half its depth, and in wall No. 4 only one third of the side of the stud was so exposed. The reflective properties of the insulation tab in walls Nos. 2 and 3 would also tend to increase the surface temperature difference by decreasing the lateral flow of heat into the sides of the stud from the warm-side air space.

The effect of insulation location may also be noted from a comparison of walls Nos. 6 and 7, where identical batt type insulation was installed. The outer portions of the studs in wall No. 6 were exposed to the low air temperature of the space, while in wall No. 7 the entire stud was in a region of much higher temperature. The lateral heat flow from the sides of the stud in wall No. 6 and the rate of heat flow into the face of the stud would be greater, with a consequent lowering of surface temperature over the stud.

Wall No. 8 was essentially the same as wall No. 7, except that a slightly thicker and more uniform mineral fiber insulation was installed. It is included for comparison with wall No. 9 to illustrate the effect of increasing the thickness of insulation in the stud space. As can be noted, increasing the thermal resistance of the stud space will tend to increase surface temperature difference. Wall No. 10 is a further example of this effect.

The marked influence of lateral heat flow on surface temperature pattern is again apparent from the results for wall No. 11. This represents an example of poor insulation application and will be discussed later. It is included here as a case of extreme horizontal surface temperature difference.

Comparison of the results presented in Fig. 1 indicates that the lateral flow of heat within frame walls may have an appreciable effect on the warm-side surface temperature pattern. The location of semi-thick insulation within the wall has a marked effect on surface temperature as does the fit between the insulation and studding.

Certain general principles of frame wall design for uniformity of surface temperature are suggested by these results. Specifically, semi-thick batt or blanket insulations should be installed as close to the cold side of the space as practicable and should provide maximum thermal protection to the sides of the studding.

Since horizontal surface temperature gradients have implications with regard to the occurrence of both dust patterns and condensation on inside surfaces, the assessment of walls with respect to these gradients is highly desirable. Limiting criteria for surface temperature difference with regard to dust marking have been suggested by some authorities[4,5] and have been applied to building regulations.[4]

Evaluation of Wall Surface Temperature Differences: The most direct way of determining wall surface temperatures is by actual testing, but the cost of such testing for the variety of constructions possible is prohibitive. Rigorous mathematical analysis, on the other hand, is difficult if not impossible because of the extremely complex nature of the heat flow pattern. However, for certain types of wall constructions, calculations on the assumption of parallel heat flow paths may give reasonably accurate results.

The surface temperature difference and ratio of heat flow in at the stud to that midway between studding, calculated on the assumption of parallel paths for the walls in Fig. 1, are listed in Columns 7 and 8. These values were determined on the basis of data given in THE GUIDE of ASHAE.

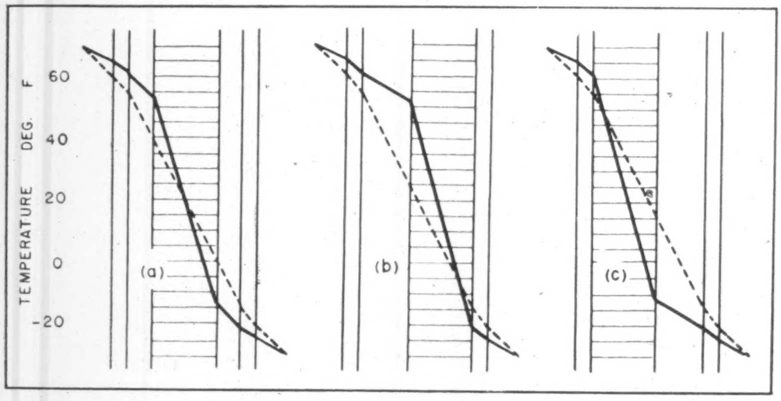


Fig. 2 — Calculated temperature gradients through a frame wall with different locations of insulation

Reasonably close agreement between calculated and observed values of surface temperature differences and heat flow ratios may be noted for walls Nos. 4, 5, and 10. Examination of the cross-sectional details of these walls will show that, in each case, the insulation was of uniform thickness across the entire width of the stud space and was symmetrically placed in relation to a plane parallel to the wall at the center of the air space. In these 2 respects they differed from the other walls tested.

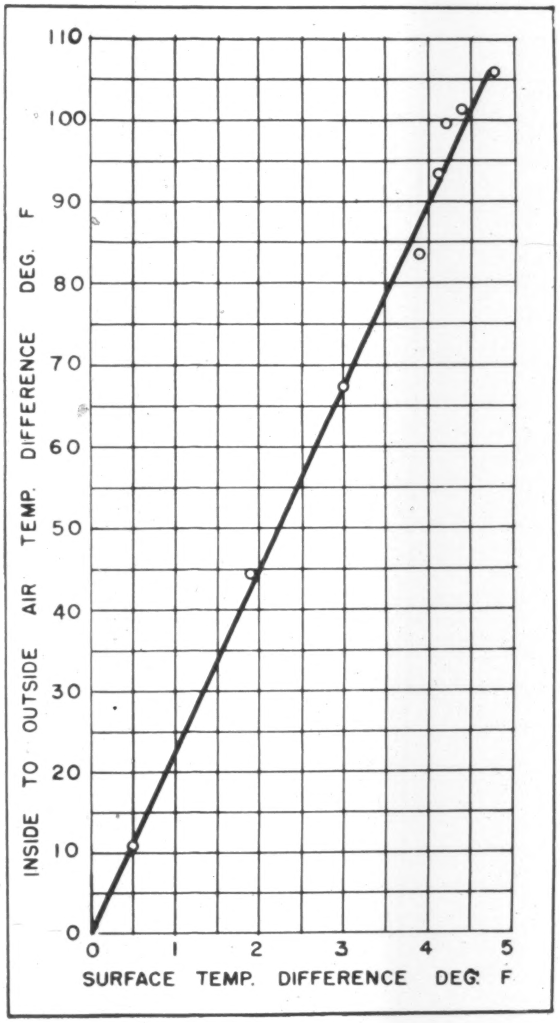
This agreement between calculated and observed values may be partially explained by temperature gradients shown in Fig. 2. In Fig. 2 (a) the calculated temperature gradients through the stud and through the stud space are shown superimposed for a frame wall with insulation located at the center of the air space. In Fig. 2 (b) the same insulation is placed at the outside, and in Fig. 2 (c) at the inside of the space.

With insulation at the center of the air space [Fig. 2 (a)] the temperature levels imposed on the sides of the stud are such that the lateral flow of heat into the stud near the warm side is balanced by the lateral loss near the cold side. The rate of heat flow into the stud will therefore approach that for a condition of no lateral heat exchange.

Location of insulation as in Fig. 2 (*b*) will expose the sides of the stud to a higher temperature regime and the additional lateral heat gain will reduce the rate of heat flow into the face of the stud. The resultant surface temperature over the face of the stud will thus be higher than that calculated by simple theory, as it was for wall No. 7.

The opposite condition will occur with insulation located as shown in Fig. 2 (c): the sides of the stud will be exposed to a lower level of temperature, increased heat loss from the sides of the stud will occur, and a lower surface temperature than that predicted will result. This condition is exemplified by the results for wall No. 6.

The interior and exterior cladding materials of this wall section have been assumed to possess identical thermal characteristics. This is not strictly true for the walls tested, but the same general relationship between temperature gradients would exist. This simple analysis, when considered with the test results, would indicate that reasonably accurate values of surface temperature difference for frame walls with plaster finish may be calculated on the assumption of parallel heat paths when insulation is installed at approximately the center of the air space of the wall and when the insulation is of uniform thickness across the width of the stud space.



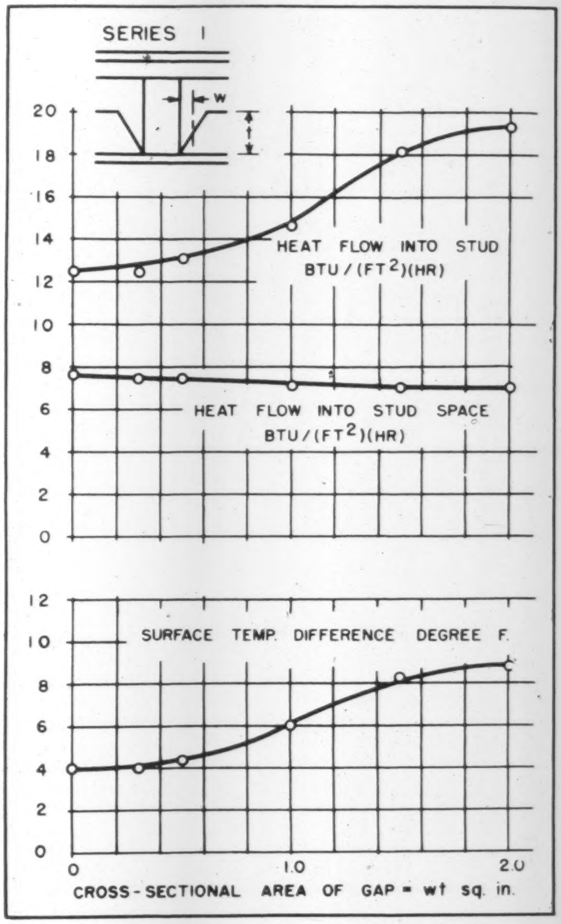


Fig. 3 *(left)* — **Surface temperature difference as related to overall air temperature difference**

Fig. 4 *(right)* — **Surface temperature difference and heat flow rate as related to insulation shape — Series I**

The calculation of surface temperature difference using the foregoing procedure may also be employed as a basis for qualitative assessment of walls in which the insulation is installed in the cold side of the space. The calculated value in such cases represents a maximum, and provided this does not exceed the accepted criterion, the wall may be regarded as acceptable.

The assessment of walls in which the insulation is installed in the warm side of the space is more difficult, first because a limit cannot be established by simple computation, and secondly because the shape of the insulation at the stud has a marked influence on the surface temperature pattern. For a specific type of wall construction and insulation, however, test data may be used as a basis for assessment, or at least for evaluation of limiting conditions.

The majority of houses in Western Canada are of reasonably standard frame construction; the most widely used insulation is of the mineral wool or glass fiber batt type, nominally 2 in. thick. The most common wall construction is of the type shown for wall No. 6 in Fig. 1. The maximum surface temperature difference to be expected with 2-in. batt insulation may, therefore, be assumed as 4.5 F when the inside-to-outside temperature difference is 100 F, provided the insulation is of uniform thickness across the stud space. For walls with this type of insulation installed between this position and the center of the air space a value may be assumed as between the limits of 4.5 F and the calculated value of 2.8 F, under the same ambient conditions. When the design temperature difference is other than 100 F proportionality may be assumed. This assumption of proportionality is inherent in the calculation procedure and is reasonably correct for walls such as No. 6, as shown by the test results in Fig. 3. The plotted points were obtained for wall No. 6 at different inside-to-outside air temperature differences ranging from 10 F to 104 F.

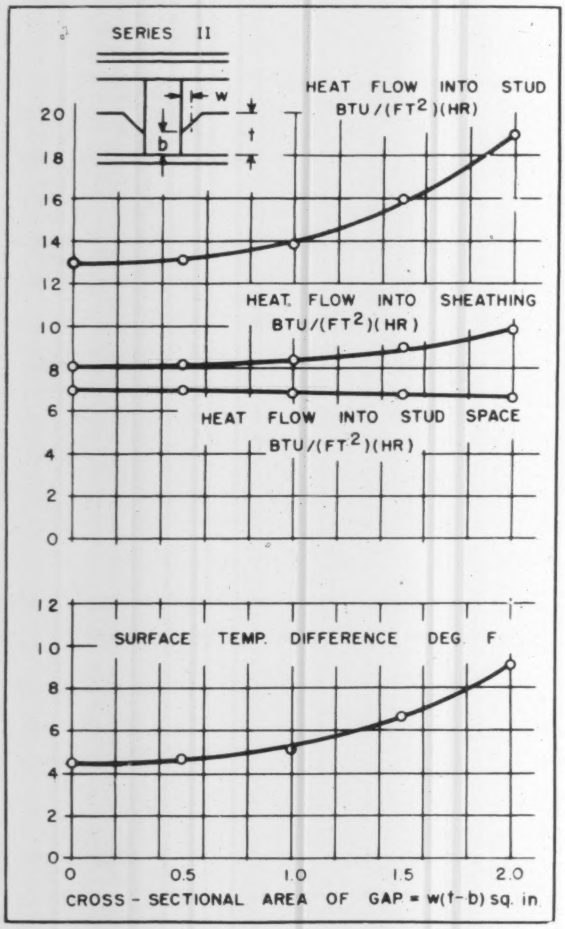


Fig. 5 — Surface temperature difference and heat flow rate as related to insulation shape — Series II

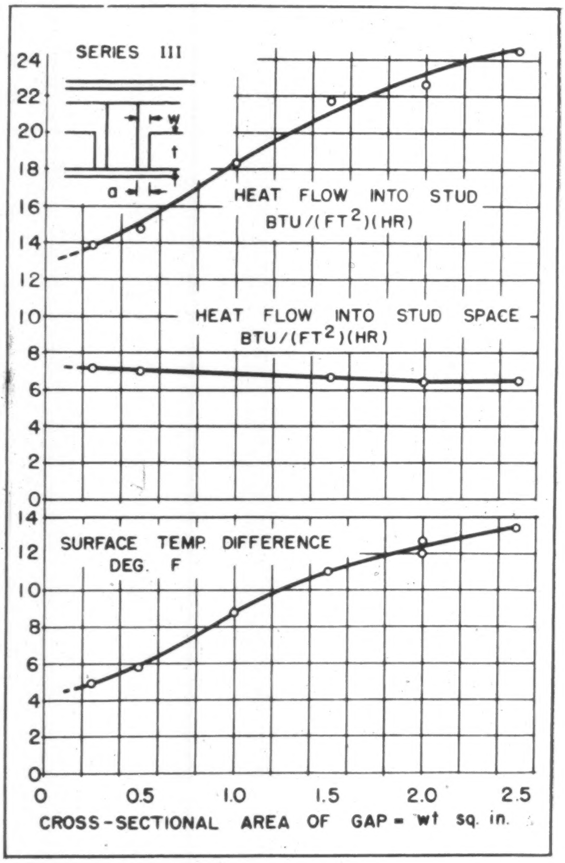


Fig. 6 — Surface temperature difference and heat flow rate as related to insulation shape — Series III

Insulation Fit at Studding: These procedures for calculating wall surface temperatures are dependent on the insulation being of constant thickness across the entire width of the stud space. Many batt and blanket type insulations do not have a truly rectangular edge profile, and in some cases may have a cross-section approaching that of the reflective insulation in wall No. 1. Also the spacing of studding in actual construction does not always coincide with the 16-inch module, and in some cases a condition analogous to that of wall No. 11 may occur. A survey of houses in Canadian cities in 1951 indicated that 5 percent of the wall area, exclusive of window and door openings, had stud spacings which were greater than 16½ in.[6]

To evaluate the relationship between insulation fit at studding and surface temperature variation, three series of tests were conducted using a uniform, light density, glass fiber insulation, 2 in. thick, which was cut to provide varying degrees of exposure of the stud. The main purpose of this study was to provide a basis for rating batt insulations in regard to surface temperature patterns in terms of their measured profile, without recourse to actual testing.

The results of these 3 series of tests are shown in Figs. 4, 5 and 6, in which the difference in surface temperature between locations over the studding and between studding is plotted against the cross-sectional area of the space between insulation and stud. Corresponding rates of heat flow into the area over studding and between studding are also shown in these figures, and in Fig. 5 the rate of heat flow through the sheathing at mid-height of the wall is included. The conditions of test were identical in all cases, warm-side air temperatures being maintained at approximately 70 F, with cold-side air temperatures at approximately −30 F. The plotted points represent average values taken at the 2-, 4- and 6-ft levels, except for the heat flow through the sheathing in Fig. 5.

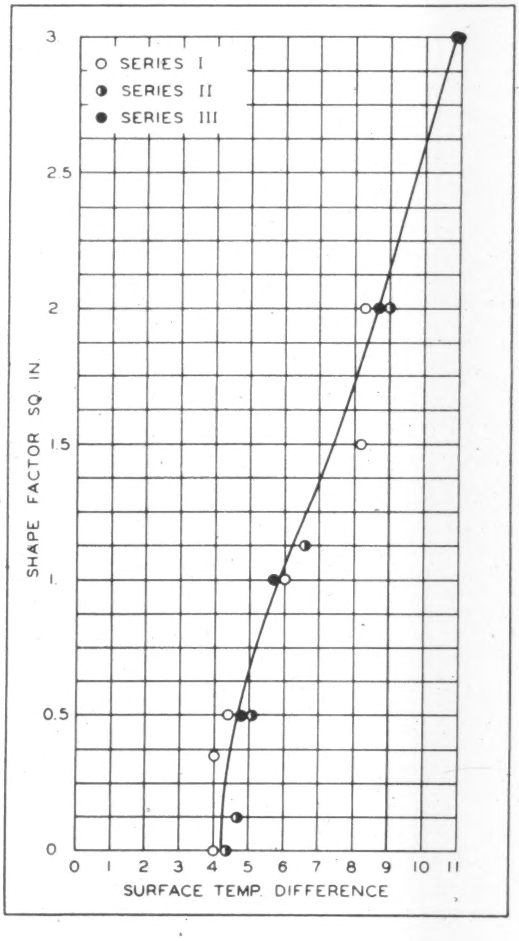


Fig. 7 — Surface temperature difference (in percent of inside to outside temperature difference) as related to *shape factor* for frame walls with nominal 2-in. batt insulation

The effect of chamferring the insulation at various angles to the stud is shown by the results of Series I tests in Fig. 4. Apparently the average width of the space between insulation and studding is most critical in the range from ¼-in. to ¾-in., as indicated by the shape of the curves for temperature difference and heat flow into studding. It will be noted that the rate of heat flow into the center of the stud space decreased slightly with increasing stud exposure. This decrease was no doubt due to the increase in temperature of the air space brought about by increased lateral heat flow from the studs.

The results of chamferring the insulation at 45 deg to the stud to provide different widths of stud exposure are shown by the Series II tests in Fig. 5. The shape of the temperature difference and heat flow curves in this figure are different from those of Series I, the rate of change of surface temperature difference increasing with increasing cross-sectional area of gap. The extreme case in Series II was identical to that of Series I and reasonably close agreement between results was obtained. For all practical purposes a mean temperature curve for the results of both Series I and Series II might be employed since the individual experimental points would fall within 1 F of such a curve.

Further evidence of the lateral flow of heat from studding to the air space and through the sheathing is provided by the heat flow measurements of Fig. 5. The rate of heat flow into the wall between studs decreased, while the rate of heat flow through the sheating increased with increasing stud exposure.

The insulation cross-sections of Series I and II approximate the general shape of some batt and blanket insulations as installed in framing which is spaced at 16 in. or less on centers. Occasionally, however, stud spacings in practice exceed this modular value and such situations must be recognized in the assessment of this type of insulation.

Series III tests were undertaken to obtain some additional information on the surface temperature patterns with oversize stud spacing. Rather than change the width of stud space, however, the insulation was reduced in width to provide gaps between insulation and studding up to 1¼ in. The results of these tests are shown in Fig. 6.

It was hoped initially that a simple correlation might be obtained for all 3 series of tests between the horizontal surface temperature difference and the cross-sectional area of the space between insulation and studding. This was the case in Series I and II, but not in Series III, where a section of the plasterboard was also exposed to the cold air space. Assuming this factor to be the significant difference between Series III and the other two, an arbitrary *shape factor* was used to provide an empirical correlation between the results of the three series of tests. This *shape factor* was calculated as follows:

Shape factor = (average thickness − thickness at stud) (average width of space + width of space at plaster).

Using the terminology of the diagrams in Figs. 4, 5 and 6,

Shape factor = $(t - b)\ (w + a)$.

The results of Series I, II and III are replotted in Fig. 7 with the shape factor as ordinate and with the horizontal temperature difference expressed as a precentage of inside-to-outside air temperature difference as abscissa. It is suggested that this relationship may be used to evaluate batt-type insulations in regard to horizontal surface temperature patterns by measurement of their profiles as installed in a mock-up wall. The test results were obtained for an inside-to-outside air temperature difference of 100 deg F, but, for practical purposes, the curve given in Fig. 7 may be employed for other conditions if a linear relationship is assumed between horizontal surface temperature difference and inside-to-outside air temperature difference. This assumption has been shown to be correct for walls such as No. 6.

In some cases the average thickness of the insulation batt may be greater or less than the nominal 2 in. An increase in batt thickness will tend to raise the surface temperature between studding and at the same time will lower the temperature of the air space, thus tending to increase the lateral heat loss from the studs. It is reasonable to assume, therefore, that an increase in batt thickness will increase the surface temperature difference and this will be accounted for qualitatively in the calculation of *shape factor*.

Conclusions

1. Horizontal surface temperature patterns exhibited by frame walls are greatly influenced by the position of the insulation within the wall and by the degree of exposure of studding to the air in the wall cavity.

2. When semi-thick batt or blanket insulations are employed, more uniform horizontal surface temperatures are obtained with the insulation installed as close to the cold side of the space as possible.

3. It is most desirable from the standpoint of minimum horizontal surface temperature variation that semi-thick batt or blanket insulations which are to be located toward the warm side of the air space provide protection corresponding to a substantial proportion of their thickness at the studding.

4. Calculation of surface temperature differences on frame walls on the assumption of parallel heat flow paths may provide reasonably accurate values provided the insulation is of uniform thickness from stud to stud and is approximately centered in the confines of the space.

5. When the insulation is placed toward the outside of the stud space calculation of surface temperatures on the assumption of parallel heat flow paths results in higher values of surface temperature difference than actually occur.

6. When the insulation is placed in the warm side of the stud space adjacent to the inside finish, calculated values of the difference in surface temperatures over and between studs are substantially less than actually occur. The fit of the insulations at the stud has a marked effect on the surface temperature pattern. Data are presented which permit the prediction of horizontal surface temperature difference for batt and blanket insulations taking into account the shape of the insulation in the vicinity of the stud.

Acknowledgment

The author wishes to acknowledge with thanks the assistance of D. G. Cole in the taking and recording of the data used in this study. The comments and suggestions of Dr. N. B. Hutcheon and other members of the staff of the Division of Building Research, Ottawa, are also greatly appreciated. This paper is a contribution from the Division of Building Research, National Research Council of Canada, and is published with the approval of the director.

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COUNCIL REGULATIONS ON HONORARY MEMBERS AND FELLOWS

The Council of the Society has approved a form for the proposal of Honorary Members and Fellows. The forms are available from the headquarters office of the Society upon request.

An Honorary Member may be any notable person of preeminent professional distinction.

The grade of Fellow shall have an honorary status, which may be conferred upon a MEMBER of professional distinction but for which he may not apply. (See By-Laws, Art. II, Sec. 3(d))

Proposals for the election of Honorary Members and conferring the grade of Fellow shall be submitted on forms approved by the Council and shall be signed by two-thirds of the members of the Council. A resume of the nominees qualifications and attainments must be included and the completed forms shall be submitted by the Executive Secretary to the Honors and Awards Committee for review and recommendation to the Council. All proposals shall be filed with the Executive Secretary by August 1.

Thermal Circuit Analysis for Developing Application Engineering Information

By Stanley F. Gilman[*] and O. William Clausen[**], Syracuse, N. Y.

SUMMARY — The need for application engineering information that accounts for the effect of thermal storage on cooling loads is indicated. The Nottage Technique is selected, and experiences with thermal circuit methods of analysis are reported. Merits and limitations of the technique are detailed. Procedures are given for reducing the labor involved and minimizing the possibilities of error. It is found that engineers become adept at circuit analysis after handling a few problems. Methods are described which considerably simplify the development of extensive application engineering information.

In designing the air-conditioning system for a commercial building, the objective of the application engineer is to select refrigeration equipment that will closely match the peak cooling load. However, accurate evaluation of this peak load is difficult. The outdoor temperature and the position of the sun in the sky are continually changing. Lights are turned on at the beginning of the work day and off at the end. Radiation portions of heat gains are stored in the structure and released later. Hence the problem is one of unsteady-state heat flow, which even under simple conditions can be very difficult to solve.

Temporary storage of heat in structures and furnishings complicates evaluation of the actual equipment (cooling) load. Consequently, heat gains are generally considered to be cooling loads; *e.g.*, the entire sun heat gain and heat equivalent of the lighting wattage are presumed to appear immediately at the refrigeration equipment. The effect of thermal storage is to reduce the refrigeration capacity required for a particular installation; when radiation heat gains are large the reduction is considerable. Therefore, it is essential that application engineers have data properly accounting for thermal storage effects.

During the past few years, the problem of thermal storage has been receiving more attention, undoubtedly stimulated by the 1949 paper of Mackey and Gay[1]. Since that time several ASHAE papers have been written. Further impetus was provided by 2 papers by Nottage and Parmelee of the ASHAE Research Laboratory[2,3]. They promoted the concept of representing the thermal problem by a *thermal circuit diagram* using electrical symbols for the equivalent thermal properties. Of particular significance, it was shown that the resultant network could be solved without recourse to higher mathematics. In addition, many problems could be solved by manual computation; *i.e.*, large analogue or digital computers were not essential for solving the equivalent electrical networks.

The most recent ASHAE laboratory paper[4] presents an analysis of a typical commercial office building. From an application engineer's viewpoint, this circuit would certainly be regarded as complex. Therefore, a basic problem is to devise means by which application engineers can profit from the thermal circuit method of cooling load analysis.

The key to exploiting thermal circuit analysis seems to be in training a small nucleus of engineers in the method. These engineers could be given the assignment of developing application engineering information of a general nature. Ideally, this would consist of simple multiplying factors to apply to the present load calculation data. In any case, the information must be presented in a simple form that can be used quickly to select equipment for any type or size of building, no matter what its orientation or geographical location.

A second responsibility of the group would be to make thermal circuit analyses of special field problems that are ordinarily sent into the home office.

The purpose of this paper is to report the experience of the authors' company in learning and utilizing the thermal circuit method of analysis. As would be expected, the experience has disclosed merits and limitations of both the method and the particular procedure used to solve the circuits. These are reported in some detail. In addition, procedures for developing extensive application engineering information are described, as well as some of the difficulties yet to be overcome.

Simpler Problems

To gain familiarity with the mechanics of the procedure of thermal circuit analysis, initial problems were simple ones having known solutions. A 4-in. gypsum panel problem which appeared in a 1932 ASHAE paper[5] was solved with the panel divided into 2, 3 and 4 lumps. Results were compared with Fig. 31 of the paper[5]. Agreement was excellent with 4 lumps, good with 3 lumps, and only fair with 2 lumps. Although it was known that the accuracy improves as the number of lumps is increased, experience was gained in predicting the *influence* of the number of lumps on the solution.

The procedure given in Table 5 of this work[5] for expressing the temperature input as a Fourier series was followed. Calculations and comparisons showed that 24 hourly temperatures were sufficient, rather than

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[1] Exponent numerals refer to References.

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the 72 used by Houghten[5], thus reducing the subsequent calculations to one-third. The number of harmonics needed for good representation is also important, since each harmonic requires a separate solution of the network. For symmetrical waves, such as outside surface temperatures of flat roofs, 2 or 3 harmonics are usually sufficient. For non-symmetrical waves; *e.g.*, east and west wall outside surface temperatures, 3 to 5 are often needed.

The procedure described by Nottage and Parmelee[2,3] was followed throughout. Each point in a network at which a thermal current balance is made yields 2 linear algebraic equations. Hence a 9-point circuit yields 18 linear equations in 18 unknowns to be solved simultaneously.

In this paper, *Nottage Technique* is used to denote their method[2,3] of solving the network, as contrasted with solving it by analogues or other devices or procedures.

By restricting the initial circuits to a maximum of 5 junction points, hence 10 equations, solutions were obtained for several other sample problems by manual computation with desk-type calculators. Sets of 10 equations or less are readily solved by available arithmetical techniques[6]. Results were checked by substitution back into the original equations.

After considerable experience with single walls and roofs, a more involved circuit was set up which included radiation exchange between surfaces. The problem was one already solved by Mackey and Gay[7], and presented the additional complication of an adiabatic surface. This is a boundary surface through which heat does not flow in either direction, and requires consideration of a resistance-capacitance series branch. Selection of this problem also provided opportunity to compare the Nottage Technique solution with both the theoretical solution and results from an hydraulic analogue[7].

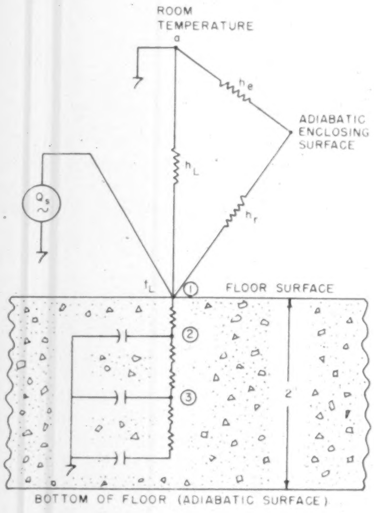
ROOM TEMPERATURE
a
h_e
ADIABATIC ENCLOSING SURFACE
h_L
Q_s
h_r
t_L
①
FLOOR SURFACE
②
③
2"
BOTTOM OF FLOOR (ADIABATIC SURFACE)

Fig. 1—Thermal circuit diagram of 2-in. concrete floor problem

The problem involves solar radiation falling uniformly on a concrete floor, and a surrounding adiabatic enclosure. The thermal circuit diagram is presented in Fig. 1. The floor has been divided into 3 lumps of the same thickness. Heat is removed at point *a* at just the rate to maintain the room temperature constant.

Current balances were made around points 1, 2 and 3 in Fig. 1, and the circuit equations were solved. Results are presented in Fig 2. Except where 2 lines appear, the *theory* and *Nottage Technique* curves are one. The agreement is therefore excellent. Also, the hydraulic analogue results[7] compare favorably with the curves.

Next, the floor thickness was increased to 6 in. and the thermal circuit solved again. Comparison of the cooling load curve with that of Mackey[7] again showed excellent agreement.

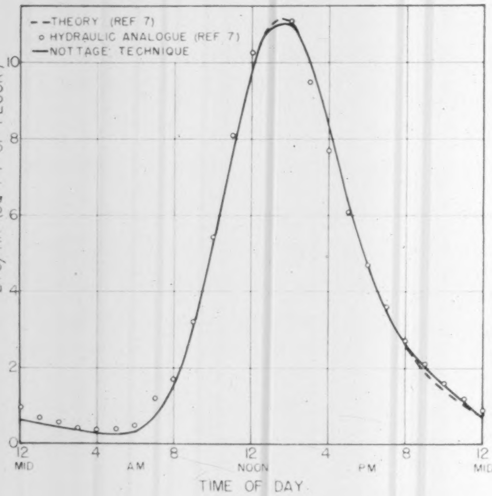

Fig. 2 (*left*) — Cooling loads for 2-in. concrete floor problem as obtained by three methods

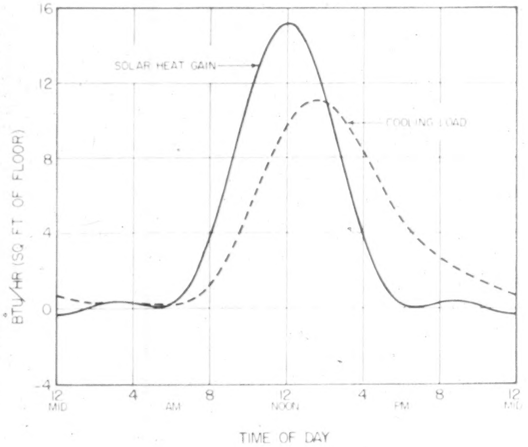

Fig. 3 (*right*) — Cooling load and solar heat gain for 2-in. concrete floor problem

To illustrate the practical aspects of the results, Fig. 3 shows both cooling load and heat gain curves for the 2-in. concrete floor. The peak cooling (equipment) load is only 73 percent of the peak heat gain and occurs 1½ hours later. By standard calculation procedures, 12 noon would be taken as the time of the peak load. However, at noon the cooling load is only 64 percent of the heat gain.

For the 6-in. thick concrete floor, comparisons were even more striking. At noon the cooling load was only 55 percent of the heat gain.

Results of the thermal circuit analysis of the Mackey problem[7] brought conviction of the validity of the Nottage Technique and that it was being properly applied to periodic heat flow problems.

Extension of Results

In concrete construction, vermiculite is sometimes used as aggregate in place of stone or gravel. The resultant mixture is lightweight and has high thermal resistance, whereas conventional concrete is heavy and has low thermal resistance. To study the effect of vermiculite, it was only necessary to re-solve the circuit after assigning new values to the resistors and capacitors[3] buried in the floor surface (see Fig. 1). Results for the 2-in. floor are presented in Fig. 4 and are striking in that, for engineering purposes, there is no thermal storage. The peak cooling load is 98 percent of the peak heat gain and the time lag is negligible.

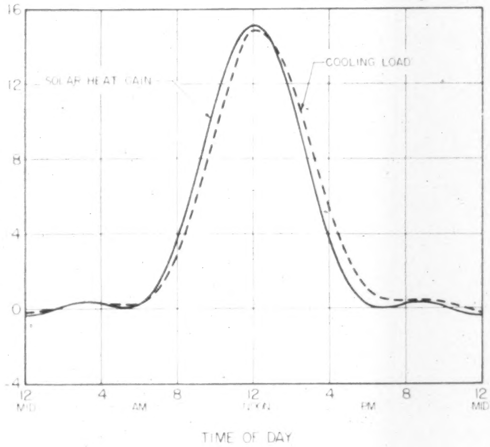

Fig. 4 (left) — Cooling load and solar heat gain for 2-in. vermiculite aggregate concrete floor problem

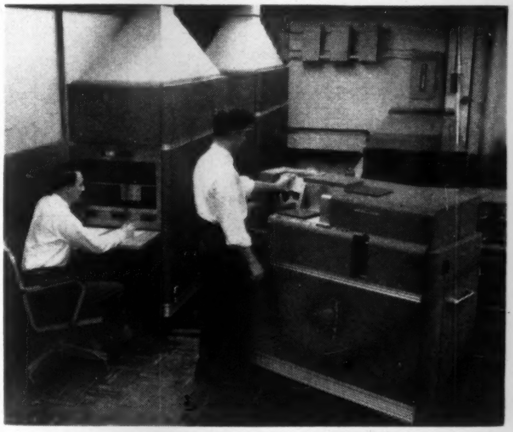

Fig. 5 (right) — 650 magnetic drum, data-processing machine

When the 6-in. floor was similarly treated, the peak cooling load was found to be 87 percent of the peak heat gain. Thus, the conventional concrete floor 2 in. thick had more thermal storage than 6-in. floor with vermiculite aggregate.

Valuable information was obtained from these thermal circuit analyses. Thermal storage in 2-in. concrete floors with vermiculite aggregate was found to be negligible. For engineering purposes, the solar heat gain and cooling load are the same for thicknesses less than about 3 in. Thermal storage in conventional concrete construction is considerable; hence, application engineering data should clearly differentiate between these 2 constructions. Therefore, this additional experience with thermal circuit analysis indicated the potential influence of construction materials on cooling loads.

More Complex Problems

The next step was to attack more complex problems involving spaces enclosed by outside walls, windows, interior partitions, floors and roofs. For such spaces it was soon found that the resultant thermal circuits involved a minimum of 8 junctions, and that usually more were desirable. Therefore, utilization of the Nottage Technique posed the problem of finding economical means of solving 16 or more equations simultaneously.

For some sets of 28 equations, a special method was devised based on mathematical *relaxation* principles[8]. Although this method was handled easily by computation personnel with only desk-type calculators, it required about one week's work per harmonic. Therefore, for many of the problems 3 weeks to a month elapsed before the solution became available. Since the next step in the analysis often depended on the solution of a previous circuit, the time required to solve circuits slowed progress on the program.

Fortunately, at about this time a commercial 650 computer was delivered to the company. This is a magnetic drum type, card programmed digital computer (Fig. 5). The person seated is at the main console which contains the control panel (visible), magnetic drum, and electronic circuits for performing the arithmetic operations. The drum can store 2000 ten-digit numbers in its *memory* for an indefinite time. To the rear of the console is the power supply unit. In the right foreground is the input-output unit in which instructions and data punched on cards are placed. Problem solutions come out of this unit as punched cards, which are then placed in an auxiliary machine that converts holes in the cards to printed numbers.

Investigation disclosed that a general routine was available whereby any number of simultaneous equations, up to 41, could be solved by the machine. The time to solve a set of 28 equations is slightly less than one-half hour, or roughly *1 percent* of the time by manual computation using relaxation methods. The machine made possible the rapid solution of several thermal circuits that were subsequently developed.

The most recently reported work has been application of the Nottage

Technique to a typical office for which the solution was obtained by a differential analyzer[4]. This particular problem was selected to acquire experience with thermal circuits involving blinds, plus the added complexity of a cooled ceiling panel. In addition, an opportunity was provided to compare the Nottage Technique solution with that of the differential analyzer, so as to better evaluate the potential of analogue computers for solving cooling load problems.

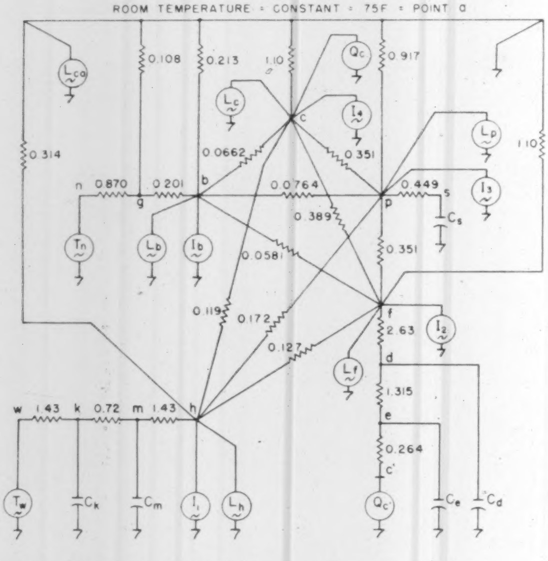

Fig. 6—Thermal circuit diagram of office problem

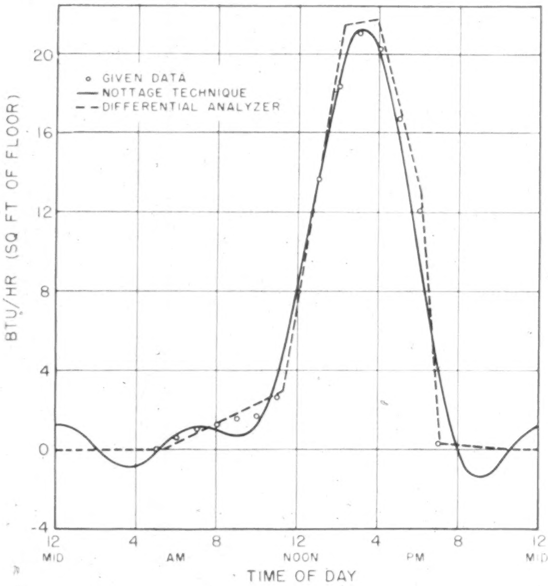

Fig. 7—Comparative representations of solar radiation impressed on venetian blinds

In the paper[4], validation of the analyzer solution is based upon the agreement between calculated and analyzer steady-state values. Apparently either time or a machine was not available for solving the sets of 18 equations for each harmonic. The set of equations for the steady-state solution could be solved by manual computation with little difficulty. In any case, agreement in steady-state values does not represent a complete check. Although the steady-state solution fixes the area under the cooling load *vs.* time curves, the *shapes* are not determined. Also, capacitors are not involved in the steady-state solution so the accuracy of the analyzer in duplicating the given capacitance values is not known. Hence, an additional objective was to complete the Nottage Technique solution of this problem.

Complete details of the office are given in Reference 4. The 12 × 25 ft room with an 8 ft ceiling faces southwest. The gross exposed wall area is 200 sq ft of which 135 is wall and 65 is window equipped with a typical venetian blind. Typical solar radiation and outdoor temperature cycles were impressed on the office, as well as a lighting load of 3.6 watts per sq ft between 8 a.m. and 8 p.m.

The equivalent electrical circuit of the thermal problem is shown in Fig. 6. The lettering system for circuit junction points of Fig. 1, Reference 4, has been maintained. Numerical values of admittance per sq ft of floor area are shown at resistors. Letter symbols are used for capacitors since their values are frequency dependent. Current balances are made at 9 junction points in the network; consequently, the Nottage Technique yields sets of 18 simultaneous equations to be solved.

After drawing the circuit diagram, the given solar radiation input data[4] were expressed as a Fourier series. The steady-state value plus the first to third harmonics were calculated. Results are shown by the solid line in Fig. 7 for comparison with the given data represented by open circles. Agreement is seen to be excellent between 4 a.m. and 8 p.m.

The straight-line segments forming the dashed curve are those generated electronically for inputs to the differential analyzer. The fit with the given data is also very good.

It should be stated that the data for all differential analyzer curves were obtained directly from the ASHAE Research Laboratory.

Comparative input data for the sol-air temperature cycle on the outside wall are presented in Fig. 8. The Fourier series representation required for the Nottage Technique fits the data very well and somewhat better than the analyzer.

Fitting data by linear segments, as done for this analyzer, is not the only way of representing input data for analogue computers. Since a Fourier series is basically the sum of sine waves of related frequencies, electronic oscillators provide another possibility. The analogue curve could then be identical to the Nottage Technique curve in Fig. 8. In addition, electronic function generators are available which will fit a continuous curve to data. In general, then, it is concluded that analogue computer inputs can accurately simulate given data.

The radiation portion of the impressed lighting load is shown by the dashed line of Fig. 9. When the lights are turned on at 8 a.m. the value jumps from zero to above 12; at 8 p.m. it jumps back to zero. Mathematically these jumps are finite discontinuities in the curve. Although such curves can be represented by Fourier series, for the same number of harmonics the fit is ordinarily not as good as with continuous functions. The solid line shows the Fourier series representation when the first 4, odd, harmonics are used. The fit is satisfactory.

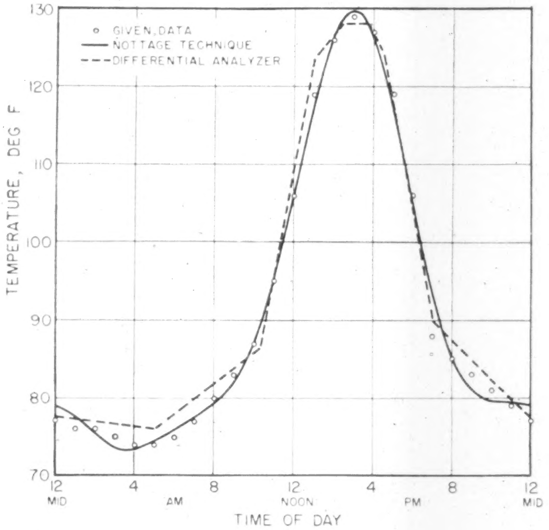

Fig. 8—Comparative representations of sol-air temperatures impressed on exposed wall

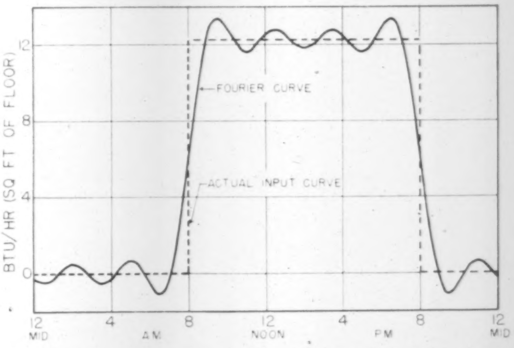

Fig. 9—Fourier series representation of lighting input with 4 harmonics

As part of a research program, our organization has collected considerable test data from office buildings. These data show that the lighting wattage increases from zero to a maximum over a period of about 1 hr. In this sense, then, the Fourier curve is a better representation of field conditions at the time office lights are being turned on and off.

After determining the input expressions for the office problem, thermal current balances were made around the 9 junction points. The circuit was solved with only the lighting load input, and then with all other inputs combined. The 18 equations resulting from the lighting input are shown in matrix form in Table 1. Within the matrix, letter symbols represent frequency dependent coefficients; their values are listed in Table 2. Solution of these by the 650 computer yielded values for the unknowns a_k, b_k, and so on, listed along the top of Table 1.

Temperature and heat flow curves corresponding to those in Reference 4 were computed and analyzed. The panel and air system cooling loads resulting from all inputs are shown in Fig. 10. Comparison of the Nottage Technique and differential analyzer results show them to be in good agreement. The area under the dashed-line curve is slightly less than under the solid line curve. This means the 24-hr average (steady-state) value for the analyzer is less, which agrees with Table 2 of Reference 4.

Small differences in steady-state values are not serious. The important factor is the relative *shapes* of the load *vs.* time curves, and reference to Fig. 10 shows remarkable agreement. Both curves have maximum values at 4 p.m. The sharp peak in the analyzer curve is caused by the linear segment inputs. The shape of each temperature and heat flow curve for individual surfaces and inputs, as obtained from the Nottage Technique solution, was very similar to the individual analyzer curves.

From this work it was concluded that analogue computers such as that described in Reference 4 have the potential of providing accurate solutions of complex cooling load problems. At present, several different analogue computers are being studied to determine their capabilities for handling diversified types of heating and air-conditioning research problems.

Merits and Limitations of the Nottage Technique

Experience with the thermal circuits discussed, as well as many additional ones, has disclosed several merits of thermal circuit analyses and of the Nottage Technique in particular. Although the procedure in the original paper[2] appears formidable, it has been found that engineers become adept in circuit analysis after working a few problems. Circuit diagrams such as Fig. 6 are very helpful in visualizing the thermal problem. They also aid in predicting the influence of particular factors; for example, a high admittance value indicates an easy heat flow path.

One limitation of the Nottage Technique is the amount of labor involved in solving several sets of equations simultaneously when only

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desk-type calculators are available. This limitation was overcome by the 650 computer. In addition, the computer eliminated a considerable amount of labor during other phases of a thermal circuit analysis. The machine was programmed to develop Fourier series expressions when given 24 hourly values of temperature or heat flow. With the given input data, the machine calculated the Fourier coefficients for any or all of the first 10 harmonics. For the usual input function, machine time was about 1 minute.

With another 650 computer program, temperatures or heat flows as a function of time were computed using the previously determined Fourier coefficients. Plotting these and the input data on the same graph permitted the closeness of the Fourier series fit to be appraised. This same program was used to take the results from the simultaneous equation solution and compute the final temperatures and heat flows. The time required was also 1 min.

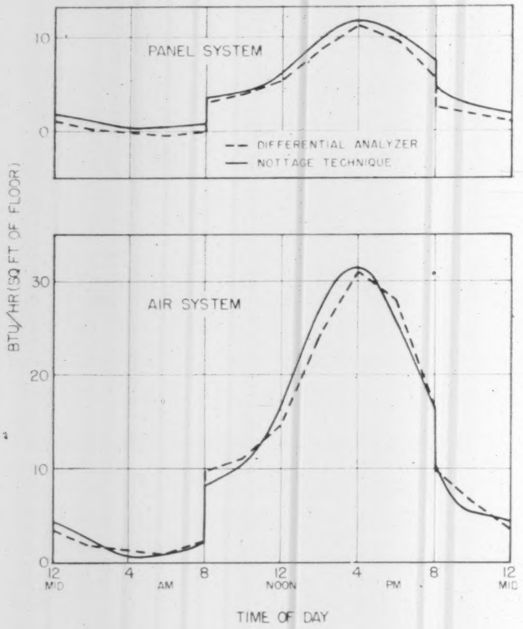

Fig. 10—Comparative air and panel system loads for office problem

By utilizing the 650 computer, engineering effort was primarily devoted only to diagramming the thermal circuit, formulating the equations (see Table 1), and analyzing the results. Indeed, after some experience, computation personnel became adept at making the current balances and writing the equations.

With the multiplicity of details involved in a thermal circuit analysis, the probability of making errors is high. Therefore, means of avoiding errors were studied. The solution of each set of simultaneous linear equations[4] was checked by substituting the answers back into the original equations. Circuit constants; *i.e.*, admittance values; could be checked individually.

The greatest probability of error was in making current balances, expanding and separating the equations, and getting them into matrix form. Study disclosed that the matrix of the coefficients had distinct characteristics that facilitated setting it up and checking it. In fact, it was possible to write down the coefficients without making current balances at all.

Table 1—Typical arrangement of circuit equations to be solved

	POINT k		POINT m		POINT h		POINT f		POINT d		POINT e		POINT g		POINT b		POINT p		
	a_k	b_k	a_m	b_m	a_h	b_h	a_f	b_f	a_d	b_d	a_e	b_e	a_g	b_g	a_b	b_b	a_p	b_p	Q
1	−2.15	−A	+0.72																0
2	−A	+2.15		−0.72															0
3	+0.72		−2.15	−B	+1.43														0
4		−0.72	−B	+2.15		−1.43													0
5			+1.43		−2.16		+0.12										+0.17		0
6				−1.43		+2.16		−0.12										−0.17	−H
7					+0.12		−4.65		+2.63						+0.05		+0.35		0
8						−0.12		+4.65		−2.63						−0.05		−0.35	−K
9							+2.63		−3.94	−C	+1.31								0
10								−2.63	−C	+3.94		−1.31							0
11									+1.31		−1.57	−E							0
12										−1.31	−E	+1.57							0
13													−1.17		+0.20				0
14														+1.17		−0.20			0
15							+0.05						+0.20		−0.61		+0.07		0
16								−0.05						−0.20		+0.61		−0.07	−L
17					+0.17		+0.35								+0.07		−F	−G	0
18						−0.17		−0.35								−0.07	−G	+F	−M
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

The principal characteristics will be described in conjunction with Table 1 and Fig. 6. In the table, junction points in Fig. 6 at which current balances are to be made are listed along the top. The unknown *a* and *b* components (real and imaginary, respectively) of the temperature vector are listed beneath each point. Row numbers 1-18 are listed along the left margin and column numbers 1-18 along the bottom. The unnumbered column at the extreme right contains known heat flow input values which are to the left of the *equals* sign when written in equation form. For example, row 6 represents the equation:

$$- 1.43b_m + 2.16b_h$$
$$- 0.12b_f - 0.17b_p - H = 0$$

To conserve space, only the first 3 digits of each coefficient are given in Table 1; the more precise values actually used in the solution appear in Fig. 6. Letters such as *A* and *B* refer to coefficients whose values are different for each harmonic; *i.e.*, coefficients which are frequency dependent. Numerical values are listed in Table 2.

The order in which junction points are listed at the top (*k, m, h,*) is not important, but it is important that current balances be made around each point in the same order. When this procedure is followed the matrix of coefficients is symmetrical about its principal diagonal. This diagonal is formed by an imaginary straight line connecting the arrowheads in the upper left and lower right. *Symmetrical* means that the same number occurs in corresponding blocks on either side of the principal diagonal. For example, the row 5, column 17, value is +0.17. Interchanging rows and columns, +0.17 should also appear in row 17, column 5, which it does. This, then, is one check on all elements of the matrix except those along the principal diagonal.

All elements along the principal diagonal have the same row and column numbers. When a number lies in a block along the diagonal, considerable information can be obtained. Consider the element, row 6, column 6, in which appears the number +2.16. Since it lies along the diagonal and under b_h of point *h*, this equation is a result of the current balance around point *h*. Moreover, since it appears under b_h, it is the imaginary part of the equation. The real part is evidently the equation along row 5 because the element along the diagonal of the matrix and under a_h is in that row.

Further scrutiny will disclose that only real parts occur along odd numbered rows and only imaginary parts along even numbered rows.

Starting in the upper left and progressing down the diagonal, each value is seen to occur twice, first negative and then positive. The signs are therefore easily checked. Furthermore, each number represents the sum of all admittances around the point indicated at the top of the column. For example, −4.65 at row 7, column 7, is the sum of all admittances about point *f* in Fig. 6. Values along a row but not on the diagonal represent the admittance between the point indicated at the top of its column and the point around which the current balance is being made. For example, in row 7, column 15, is found 0.05. Column 15 is under point *b*. The element along the principal diagonal (row 7, column 7) is under point *f*. Therefore, 0.05 is the admittance between points *b* and *f*. Reference to Fig. 6 shows the first 3 digits are indeed 0.05.

It may appear strange that point *c* does not appear in Table 1. The conditions of the ASHAE problem are that point *c* is always maintained constant at 75 F, which is also the room air temperature. Hence, point *c* is a junction at which the temperature is known; therefore, it does not appear in the list of unknown temperatures in Table 1.

Letters *A*, *B*, *C*, and *E* in the matrix represent capacitors in parallel with resistors. They are always preceded by a negative sign and take positions under their points in blocks just to the right and left of the principal diagonal in the odd and even rows, respectively.

Only under point *p* does a frequency dependent coefficient occur along the principal diagonal. Inspection of Fig. 6 reveals that in summing the admittances around point *p* a resistance-capacitance series branch is involved. Since the capacitor is frequency dependent, the total admittance value is likewise frequency dependent. Values for *F* are included in Table 2.

By taking advantage of regularities in the matrix of coefficients, it was possible to eliminate considerable labor in writing the equations and, even more important, develop a checking procedure minimizing the possibility of errors.

The limitations of the Nottage Technique must also be recognized. With respect to developing application engineering data, the most serious is the inability to handle other than periodic heat flow problems. For cooling equipment that is operated 24 hr a day, the technique can be used to develop a considerable amount of data, as will be shown subsequently. However, many air-conditioning systems are shut-down overnight. This mode of operation results in a rise in room air temperature followed by an early morning pull-down with the refrigeration equipment. Intermittent equipment operation introduces transient heat flow conditions that are better handled by analogue computers or numerical techniques such as the popular Schmidt method[9].

Another limitation is that a linear circuit must be assumed, which means that resistors and capacitors are independent of temperature or heat flow. It is known that inside film coefficients, for example, are a function of temperature difference. Whether or not such nonlinearities have serious influence on thermal circuit solutions remains to be proved.

Additional thermal storage can be made available by allowing the room air temperature to vary. When a specified variation is impressed on a thermal circuit, the Nottage Technique is easily applied. However, when the variation in room air temperature is the unknown, the Nottage Technique becomes complex. Unfortunately, the latter condition is of more practical concern.

A study of typical configurations and conditions for which application engineering information is desired indicates an analogue computer capable of handling non-linear problems will be the eventual replacement for the Nottage Technique.

Table 2—Numerical values for frequency dependent elements in Table 1

Element	1st Harmonic	3rd Harmonic	5th Harmonic	7th Harmonic
A	0.413	1.239	2.065	2.890
B	0.413	1.239	2.065	2.890
C	0.685	2.050	3.420	4.800
E	0.725	2.175	3.620	5.070
F	1.873	1.915	1.995	2.104
G	0.110	0.323	0.518	0.688
H	0.261	0.087	0.052	0.037
K	1.077	0.359	0.215	0.154
L	0.147	0.049	0.029	0.021
M	0.777	0.259	0.155	0.111

Developing Application Engineering Information

In developing information for application engineers to use in accounting for thermal storage in structures, considerable attention must be given to the manner in which the information is presented. In the field, time is of the essence. Therefore, all data must be in the simplest possible form so equipment can be quickly selected. Moreover, all buildings differ in some respects so the information must be extremely general in nature. A few of the variables are: (1) lighting load, (2) percent glass area, (3) type of window shading, (4) direction that each outside wall faces, (5) structural materials, and (6) outdoor weather conditions during a design day.

An added complexity is that thermal storage influences the equipment load during all hours of the day, not just during the time of the peak heat gain. Referring to Fig. 3, the cooling load is less than the heat gain until 2 p.m., after which time the load is greater than the heat gain. At 4 p.m. the load on this south exposure is double the calculated heat gain. Buildings usually have more than one exposure, *i.e.*, one outside wall may face south and another west. Thus, in determining the maximum load that the central station equipment must handle, and the time this load occurs, heat gain *vs.* cooling load relationships for *all exposures* must be considered. The relative area of each exposure also influences the load calculations.

Considering all the combinations of variables that are involved, it is evident that developing curves similar to Fig. 3 for each condition would be an impossible task. Therefore, methods had to be found for developing the information with a reasonable expenditure of time and money.

Study disclosed that the presumed linear nature of the circuit results in considerable simplification. First of all, each input can be applied separately to a circuit and the results added to determine the total effect. After selecting a typical office configuration and construction, the effect of outdoor temperature cycle, solar radiation, and lights can be determined individually. A series of temperature cycles typical of geographical regions can then be impressed separately and the circuit solved. Solar radiation inputs for East, Southeast, South, and so on, and 2 or 3 latitudes add to the data obtained. Then, for a particular region, appropriate temperature and solar radiation results are merely added together.

For different lighting intensities, the procedure is simple. Presume 3 watts per sq ft are impressed on a structure over a specified period of time and the cooling load *vs.* time curve is found. A lighting load of double this amount (6 watts per sq ft) merely doubles the previous load value at every instant of time. Stated differently, the *6-watt curve* is twice as high as the *3-watt curve*. Similarly, a 2-watt per sq ft curve would be two-thirds the height of the 3-watt curve.

A change in the level of the room temperature being maintained changes steady-state values (areas under the load-time curves) but not the shapes of the curves. Hence, a load curve for an 80 F room temperature will be below that for a 75 F room temperature by an amount that is easily calculated.

Additional simplification came about by studying the influence of certain variables on circuit solutions. Some were found to be negligible while others, such as construction materials and different combinations thereof, were radically reduced in number. For example, an important variable is the percent of gross outside wall that is glass. Presume a load curve for a typical office has been determined for the condition of 30 percent glass. The load curve for 60 percent glass area is sought. The total solar radiation entering the space is double the 30 percent condition. However, the intensity per square foot of total interior absorbing surface is greater than double because the outside wall area has been decreased by the area of the additional glass. This effect was evaluated by studying the circuit diagrams and equations, as well as solving selected circuits and comparing results. The conclusion was that if the original circuit included a median amount of glass, then variations above and below had negligible effect. The significance is that linear combinations can be used; *i.e.*, the load curve for 60 percent glass can be taken as twice that for 30 percent glass.

Utilizing the experience gained in thermal circuit analysis, application engineering data for a variety of configurations and conditions, and 24-hr equipment operation, is being developed by means of the Nottage Technique.

Several difficulties are yet to be overcome. Procedures for handling either variable room temperature or shorter daily operation of refrigeration equipment are not yet completely developed. Thermal conductivity, density and specific heat data for many materials are inadequate. Influence of nonlinearities, although believed insignificant, needs to be firmly established. Finally, it eventually must be determined by collection of field test data whether or not thermal circuit solutions correctly predict the behavior of actual structures.

Conclusions

1. The Nottage Technique of thermal circuit analysis is a practical method of developing application engineering data, provided economical methods are available for solving large sets of simultaneous equations.

2. Thermal circuit analysis is a valuable tool for analyzing complex heat flow problems. Experience shows that engineers become adept at applying it after a small amount of training.

3. Analogue computers or numerical procedures appear more feasible than the Nottage Technique when transient, rather than periodic, heat flow problems are encountered.

Acknowledgments

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Acoustic Power Level Determination for Machinery in Hard Rooms[†]

By W. J. Burch[*], Annapolis, Md.

SUMMARY—The purpose of this investigation was to determine the feasibility of writing machinery noise specifications in terms of acoustic power (or acoustic power level) instead of the presently used system involving sound pressure levels. It was desired to determine if valid power level measurements could be made in acoustically untreated rooms.

Tests using 3 different sound sources in rooms of various acoustic properties show these measurements to be feasible. Various types of machinery mountings had negligible effect upon recalculated power levels (PWL).

It has long been the practice to write machinery noise specifications in terms of sound pressure level (SPL) measured at specified distances. This has objectionable limitations since the SPL depends not only on distance, but also upon the acoustic characteristics of the test location, *i.e.*, room size, acoustic treatment, and others. Since it is extremely difficult to duplicate exact room acoustic characteristics, significant discrepancies have been noted from time to time in the results obtained by different test facilities. From experience of this sort, it has become increasingly apparent that there is need for a noise level criterion which does not depend on the acoustic environment of the test location. One such criterion is acoustic power or acoustic power lever (PWL). It is also desirable to use acoustic power or PWL as the parameter for specification purposes because it is a quantity from which sound pressure level can be predicted at various distances and locations with respect to the equipment regardless of the place where the PWL was determined.

This project was undertaken to determine the practicability of calculating the PWL of a piece of machinery, located in hard or semi-hard rooms, using the SPL measured in the diffuse field and certain estimated room constants. In addition, it was desired to determine if the type of machinery mounting would cause significant changes in PWL. Also, it was desired to know, as a matter of practical experience, how accurately room constants could be estimated.

Machinery and Sound Sources Investigated

Three different sound sources, identified as follows, were used in the investigation:

1. A small 1/6-hp, electric motor driven, household type refrigerator compressor, with suction and discharge open to atmosphere.
2. A 3-hp, 2-stage, electric motor driven air compressor with suction and discharge open to atmosphere.
3. A white noise generator and amplifiers, frequency range 50 to 6500 cps.

Noise Instrumentation

Principal instruments used in the investigation included the following: (*a*) Type 1551-A sound level meter, (*b*) Type 3A frequency analyzer, (*c*) Type 633-A microphone, (*d*) EES impedance matching transformer, (*e*) Type 2304 high speed sound level recorder, (*f*) Type 2109 audio frequency spectrometer, and (*g*) Type 21B microphone.

All sound-level measurements were made with a Type 633-A microphone coupled to either the Type 3A analyzer, or Type 1551-A sound level meter. An EES designed transformer was used to match the impedance of the 633-A microphone with the sound-level meter.

Measurements of reverberation time were made with the Type 21B microphone coupled to the Type 2304 high-speed sound-level recorder through the amplifier section of the Type 2109 audio-frequency spectrometer. The diffuse noise fields for these measurements were established by use of both a discrete frequency warble tone oscillator and a white noise generator-amplifier unit.

The microphones used were calibrated, for selected frequencies in the range covered, by a substitution method using 3 reciprocity-calibrated Type 640AA condenser microphones as standards. The measurement systems were electrically calibrated at the start of each series of measurements and periodically at any other time there was reason to suspect their accuracy.

Method of Test

The first phase of the experiment was to calculate the acoustical power of the noise source in an anechoic chamber by spherical integration. In this case, the sphere was divided into 24 equal areas. The geometrical center of each area was located and the SPL was determined at this point.

The SPL was then calculated as the arithmetic average of the sound intensities. Acoustic power then is

$$W_s = 10^{-13} S \left[\text{antilog}_{10} \left(\text{SPL}_{ave}/10\right)\right] \text{ watts} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

[†] The opinions expressed in this paper are those of the writer and do not necessarily reflect the views of the Navy Department or of the naval service at large.

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where

S = area of the incremental area in square feet.

SPL_{ave} = average sound pressure level.

Total acoustic power is then

$$W = W_s \times n \quad \text{.............} \quad (2)$$

when

n = number of incremental areas.

The total sound power W in watts as expressed by the power level is

$$PWL = 10 \log_{10} W + 130 \text{ db} \quad \text{....} \quad (3)$$

The second stage of the experiment involved determination of the powers in various rooms. However, before these could be determined, it was necessary that a room constant or acoustical index be established for each of the individual rooms. This was accomplished by 2 methods. First, the reverberation times were accurately measured with the high speed level recorder and from these the room constants were calculated by Equation A-2, Appendix A. Second, the areas of each type of material in the rooms were either measured or estimated and from published absorption coefficient data the average absorptivity and room constants were determined by Equations A-3 and A-4, Appendix A. The results of these 2 methods were then compared and the PWL's were calculated by use of Equation A-1, where the SPL is the value measured in the diffuse noise field.

Nomenclature

PWL = acoustic power level re: 10^{-13} watt.
SPLd = sound pressure level in diffused field.
R = room constant (English Units).
ρc = specific acoustic impedance (407 rayls or 40.7 mks rayls/ft^3).
V = volume of room (cubic feet).
T = reverberation time in seconds.
S = area of surfaces of room, square feet.
S_a = incremental area of sphere at radius of distance of microphone from source.
a = absorptivity coefficient.
P_{ref} = reference sound pressure (0.0002 dyne/cm^2).
P = sound pressure (dynes/cm^2)
W_{ref} = reference acoustic power (10^{-13} watt).
W = acoustic power (watts).
W_s = acoustic power for a unit area.
A = average absorptivity coefficient.

In the anechoic chamber tests, the sound sources were supported by rubber band suspension from an acoustically treated overhead crane. The tests in the hard and semi-hard rooms were for the most part conducted with the sound sources mounted solidly on the floor. However, in order to determine the effect of the type of support on the power level, 3 other methods of mounting were used with the air compressor sound source in 3 of the rooms. The supports used were as follows:

1. Resilient or rubber band suspension.
2. Six cycles per second, cylindrical steel springs.
3. Engineering Experiment Station Type B7S (nominal 6 cps) mounts.

Results

Results obtained in the test are presented in tabular form as Table 1, which shows the PWL's obtained in the anechoic chamber *vs.* those obtained in the various test rooms. SPL's determined in the test rooms are also presented. Table 2 presents the estimated *vs.* calculated room constants. Sound spectrum for a refrigerator compressor used as a sound source is presented as Fig. 1. The results obtained with various types of mountings are not presented numerically; however it was observed that, in proceeding from the very soft mounting to the rigid condition, the PWL was constant within ±0.5 db.

Discussion

The data presented in Table 1 show that the PWL's determined in the test rooms were generally lower than those found by spherical integration in the anechoic chamber. The reasons for this are not exactly known; however, nonsymmetry of the sound sources, possible imperfect anechoic chamber characteristics, inherent error due to instrumentation, and specific acoustic phenomena associated with the test rooms could all be contributing factors to the discrepancies noted. On the other hand, the PWL's obtained in the majority of test rooms agreed to within ±2.0 db of the *average* value.

The data presented in Table 2 show that good agreement was found between the estimated and calculated room constants. The maximum discrepancy in these values was approximately 20 percent, with the exception of those few rooms which have ques-

Table 1 — Tabulated Results of Test

PWL = db re: 10^{-13} watt SPL = db re: 0.0002 dyne/cm^2

Noise Source	Avg PWL Anechoic Chamber	Hallway Wave Mech Lab	Calibration Room Wave Mech Lab	Vestibule Wave Mech Lab	Shock & Vibration Office Wave Mech Lab	Laundry Room Bancroft Hall USNA	Storeroom 104 Bancroft Hall USNA	Squash Court Bancroft Hall USNA	Classroom Building 120 EES	Honor Room Bancroft Hall USNA	Room 103 Bancroft Hall USNA	Crew's Mess USS TURBOT	Aft Torpedo Room USS TURBOT	
1/6 hp Refrigerator Compressor	80.0	79	77	77	81	79	77	78	—	82	79	—	—	PWL[a]
		76	81	77	81	80	78	78	—	81	79	—	—	PWL[b]
		69	67	78	63	68	61	61	—	66	65	—	—	SPL$_d$[c]
3 hp Air Compressor	102.0	98	95	—	—	—	—	—	—	—	—	—	—	PWL[a]
		95	99	—	—	—	—	—	—	—	—	—	—	PWL[b]
		88	84	—	—	—	—	—	—	—	—	—	—	SPL$_d$[c]
White Noise Generator	99.0	94	90	96	96	97	96	95	97	94	95	95	98	PWL[a]
		91	94	96	96	98	97	95	96	94	95	100	97	PWL[b]
		85	79	97	78	86	80	78	76	77	81	77	80	SPL$_d$[c]

[a] PWL Estimated: PWL calculated from the diffuse field SPL and the estimated room constant.
[b] PWL Calculated: PWL calculated from the diffuse field SPL and the room constant calculated from the measured reverberation time.
[c] SPL^d: The diffuse field SPL.

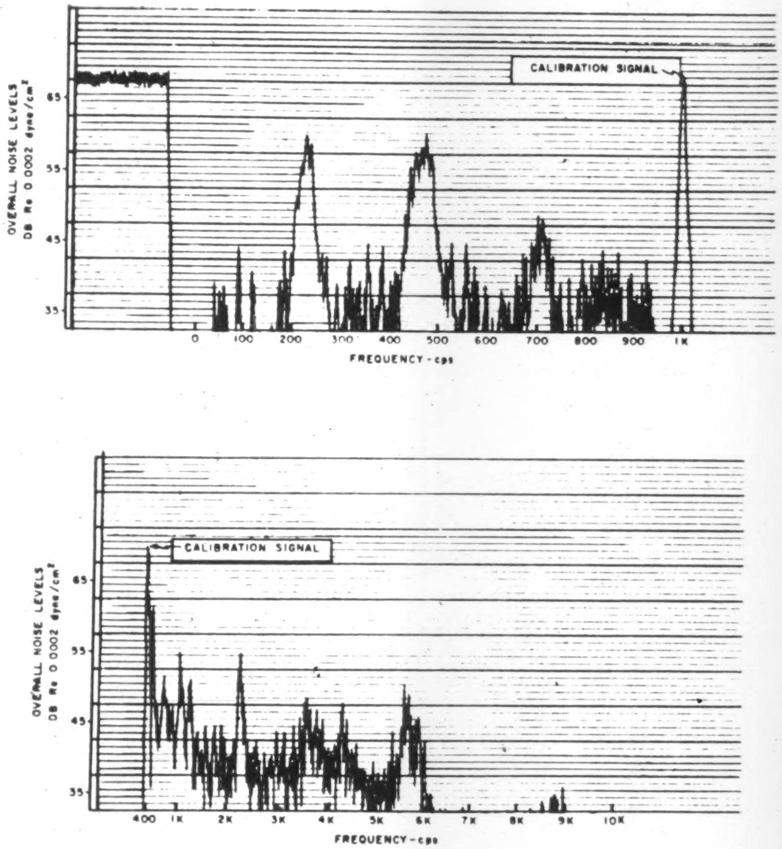

Fig. 1 — Typical frequency spectra of household refrigeration compressor (air-borne spectra)

tionable acoustic properties. The large discrepancy in the hallway values was probably caused by the 6-ft false ceiling space and oblong dimensions which tend to cause nongeometric acoustics. No explanation has been found for the large variation noted in the calibration room. The crew's mess compartment of the hulk of a typical submarine contained many partial partitions and a storage space enclosed by wire mesh. Its length was also several times its height or width. In view of these results it appears that rooms such as these, as well as rooms where the principal dimensions are not of the same order, should not be used because of the resulting nongeometric acoustics and poor diffusion of sound. However, if it becomes necessary to use a room of this kind, the reverberation time should be measured and the room constant calculated therefrom. The data also indicate that it is not necessary to use an empty or nearly empty room in order to obtain satisfactory results. In the rooms tested, essentially the same estimated room constants were calculated by at least 2 people working independently.

Table 2 — Test Room Acoustic Absorption Characteristics

Test Room	Volume of Room ft³	Area of Room Surfaces ft²	Average Absorptivity Coefficient	Estimated Room Constant	Measured Reverberation Time, Seconds	Calculated Room Constant
WAVE MECH LAB						
Hallway	400	350	0.105	41	1.00	21
Calibration Rm	3,630	2,320	0.020	47	1.50	116
Vestibule	200	226	0.020	4.6	2.20	4.6
Shock and Vibration Off.	4,650	1,702	0.145	291	0.85	295
BANCROFT HALL, USNA						
Laundry Rm	4,600	1,820	0.032	61	3.60	65
Rm. 103, basement	2,756	1,617	0.058	99	1.40	101
Honor Rm, basement	3,610	1,575	0.113	200	1.10	172
Rm 104, basement	5,900	2,881	0.052	158	1.55	196
Squash Court	10,700	3,014	0.072	233	2.30	242
BUILDING 120, EES						
Classroom	6,000	2,264	0.181	500	0.80	406
USS TURBOT						
Crew's Mess	3,910	3,015	0.081	267	0.60	833
Aft Torpedo Rm	4,590	2,245	0.111	286	1.10	218

Other Observations

It is realized that the number and size of sound sources used in the investigation were limited and that further studies involving larger and more varied pieces of equipment should be made. The limitations were imposed chiefly by considerations of portability and power requirements. These reasons also led to choice of the amplifier-speaker system as one of the sound sources.

Tests were conducted with the latter source using pure tones (both steady and warbled), but no satisfactory power could be calculated due to the standing wave patterns which were present. The tendency for standing waves to appear was also noted when the air and refrigerator compressors were used. Under given conditions, the air compressor produced a projected pattern which varied by approximately ±1.0 db, whereas the refrigerator pattern varied as much as ±2.0 db.

The location of the noise source in the room had no noticeable effect upon the diffuse SPL reading.

Conclusions

The powers determined in the test rooms were in general lower than those found by spherical integration in the anechoic chamber.

The powers determined in the test rooms agreed to within ±2.5 db of the *average* value. The maximum decibel spread was 5 and 9 db

(PWL). Corresponding spreads in sound pressure levels measured were 17 and 21 db.

The estimated room constants obtained were within approximately 20 percent of the values calculated from the measured reverberation times. This made a difference of less than 1.0 db in the PWL calculation and indicates that in most cases it will not be necessary to establish room constants by making reverberation time measurements.

The type of support used for the noise source did not significantly affect the calculated PWL's. In proceeding from the very soft mounting to the solid or rigid condition, the PWL varied by only 0.5 db.

The white noise sound source did not produce detectable standing wave patterns, while the refrigerator and air compressors produced standing wave patterns which varied ±2 and ±1 db, respectively.

Acknowledgments

Credit is given to Lt. C. E. Rakes, USN and Lt. (jg) J. E. Kaune, USN, who performed this work during summer recess from training duty at Massachusetts Institute of Technology.

APPENDIX A

Equations Used for Calculations

Power Level in Reverberant Room:

$$PWL = SPL_d - 6.0 + 10 \log R - (10 \log pc - 15.7) \quad \text{(A-1)}$$

Measured Room Constant:[1]

$$R = 0.05\, V/T\, [1 + (0.025\, V/TS)] \quad \text{(A-2)}$$

Room Constant:[1]

$$R = A\, S/1 - A \quad \text{(A-3)}$$

Estimated Average Absorptivity:[1]

$$A = (\alpha_1 S_1 + \alpha_2 S_2 + \alpha_3 S_3 + \ldots)/(S_1 + S_2 + S_3 + \ldots) \quad \text{(A-4)}$$

Power Level in Free Field:[2]

$$W_s = 10^{-13}\, S_n\, [\text{antilog}_{10}\, (SPL/10)] \text{ watts} \quad \text{(A-5)}$$

$$PWL = 10 \log_{10} W + 130 \text{ db} \quad \text{(A-6)}$$

APPENDIX B

Recommended Procedure for the Calculation of PWL in Hard and Semi-hard Rooms

Estimate the room constant by the equation:

$$A = \frac{\sum_1^n \alpha S_n}{\sum_1^n S_n} \quad \text{(B-1)}$$

α = absorption coefficient of each kind of material.

S_n = area of each surface.

A = average absorptivity.

and the equation $R = A\, S/1 - A$

$$S = \text{total area} \left(\sum_1^n S_n \right) \quad \text{(B-2)}$$

To determine the SPL *in the diffuse field:*

First determine the point at which direct field noise ceases to predominate or where the SPL per doubling of distance no longer decreases by approximately 6.0 db. This point is usually several source diameters from the noise source but varies depending on the amount of absorption material present in the room. Starting from this point an arbitrary 10 ft long straight line should be traversed, taking a reading every foot. No point on this line should be less than 2 ft from a wall, floor or any solid object nor should any point be less than $0.282 \sqrt{R}$ (R = room constant) from the piece of machinery being tested. The average of the readings is the diffuse SPL.

To determine the PWL *use the equation:*

$$PWL = SPL - 6 + 10 \log R - (10 \log pc - 15.7) \quad \text{(B-3)}$$

The portion of this equation which is in parentheses is usually less than a decibel and may be neglected in normal engineering work.

APPENDIX C

Sample Estimated Room Constant Calculation

Sample estimated room constant calculation aft torpedo room:

Material	Absorption Coefficient α	Area S_n (sq ft)	Sabins $a = \alpha S_n$
Steel (transverse blhd)	0.02	200	4.0
Corkboard (side blhd)	0.30	635	190.0
Steel (side blhd)	0.02	272	5.4
Steel (deck)	0.02	518	10.4
Miscellaneous Wood	0.10	200	20.0
Miscellaneous Steel	0.02	300	6.0
Steel Cable	0.03	200	6.0
Screen Cage			7.0
Tank (plaster)	0.04	20	0.8
		ΣS 2345 = S	Σ_a = 249.6 = ΣA

$A = \Sigma a / \Sigma S = 0.106$

$1 - A = 0.894$

$R = S\, A/(1 - A) = 249.6/0.894 = 278$

Determination of calculated room constant:

T = reverberation time = 1.1 seconds.

V = 4590 ft^3.

$R = 0.05\, V/T\, [1 + (0.025\, V/TS)]$.

$R = [4590\, (0.05)/1.1]\, [1 + [0.025\, (4590)/1.1\, (2345)]]$.

$R = 218$.

Determination of PWL:

SPL = 80.0 db.

$SPL = PWL - 10 \log R + 6.0 + (10 \log pc)$.

Estimated value PWL (using estimated R):

$PWL = 74 + 24.2 = 98.1$.

Calculated value PWL (using calculated R):

$PWL = 74 + 23.1 = 97.1$.

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[1] *Handbook of Acoustic Noise Control*, by Richard H. Bolt (Physical Acoustics, WADC Technical Report 52-204, Vol. 1, December 1952, Equations A-1, A-2, A-3, A-4, pp. 76-79).

[2] *Acoustics*, by Leo L. Beranek (McGraw-Hill Engineering Series, Equations A-5 and A-6, pp. 366-368).

Measurement of Infiltration in Two Residences

Part I: Technique and Measured Infiltration

By D. R. Bahnfleth*, T. D. Moseley** and W. S. Harris†

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS in cooperation with the University of Illinois, Urbana, Ill.

SUMMARY — Infiltration rates were measured by the tracer gas technique in the I=B=R Research Home and Warm-Air Heating Research Residence No. 2, two experimental homes located at the University of Illinois. The Research Home is located on a typical city site surrounded by trees and houses, while Research Residence No. 2 is located on a relatively open site typical of newly developed housing areas. Helium gas was released in the houses, and the time rate of decay of the helium concentration was measured and plotted. The amount of infiltration which occurred during a given test period was computed from the helium decay curves. The effects of wind direction and velocity, and indoor-outdoor temperature difference on the infiltration rates were observed. Part II of this paper will discuss the effect of the several variables on the air change rates.

During the past 10 years many data on infiltration through different types of windows, doors and wall constructions have been obtained in laboratory investigations. A comprehensive bibliography can be found in the ASHAE GUIDE[1]. While laboratory studies have provided invaluable data for design infiltration heat loss estimates, their validity is frequently questioned because of assumptions which must be made to apply laboratory data to a structure having crackage on several exposures. Furthermore, in an actual structure the combined effects of wind and temperature difference cause infiltration, whereas recognized design procedures consider only the effect of wind.

Results of an investigation of infiltration in dwellings were published[2] recently, wherein the infiltration rates were measured by the tracer gas technique[3] using helium as the tracer gas. The apparent success of this method of measuring infiltration prompted procurement by the ASHAE of a helium gas analyzer.

During the winter of 1954-55 an investigation of infiltration in residences using the helium tracer gas technique was begun at the University of Illinois in cooperation with the Society. Infiltration rates were measured in the I=B=R Research Home and in Warm-Air Heating Research Residence No. 2. The results presented here were obtained in the 2 houses during the period from the winter of 1954-55 through the summer of 1956.

The principal objective was to determine the infiltration rates of the 2 houses and to correlate infiltration rates with wind velocity and direction and indoor-outdoor temperature and pressure differences. An additional objective was to compare measured infiltration rates in the 2 houses with those calculated by the methods presented in THE GUIDE. The techniques used and the measured infiltration data are included in this paper. Part II will consider the effect of the several variables on the infiltration rates in the 2 houses and will include a comparison of the results of the investigations in the 2 houses.

Description of Residences and Instrumentation

I=B=R Research Home: The Research Home, shown in Figs. 1 and 2 and described[4] in detail in University of Illinois Engineering Experiment Station *Bulletin 349*, was a 2-story building with full basement typical of small well-built American homes. The total volume of the 2 stories was 9393 cu ft, and the basement volume was 5084 cu ft. Construction was brick veneer on wood frame, and all outside walls and the second-story ceiling were insulated with mineral wool batts 3⅝ in. thick. A vapor barrier was located between the insulation and the plaster base. The attic was ventilated by louvers in the gable ends. All windows were weatherstripped and of the double-hung type except for the wood casement windows in the kitchen. Storm doors were used on the 2 exterior doors during the winter. The windows and doors were all well fitted. Table 1 gives the crack widths and lengths throughout the house. The fireplace chimney in the living room was sealed during the study. The Research Home was located on a typical city site, surrounded by trees and houses (see Fig. 2). The largest open area was a small yard to the south. With the exception of one house, located only 12 ft from the west wall, there was no other building closer than 75 ft. The surrounding houses were predominantly 2-story structures.

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[1]Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 1957.

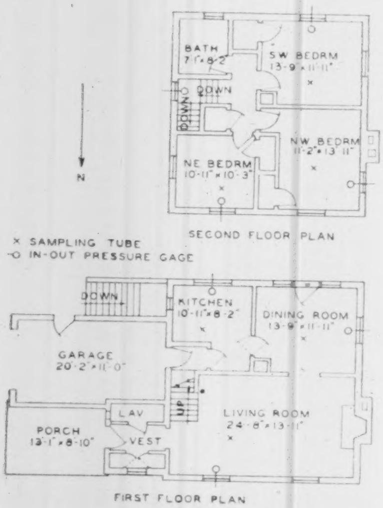

Fig. 1—Floor plans showing helium sampling tube and indoor-outdoor pressure gage locations in the I=B=R Research Home

The Research Home was heated during the winter by a one-pipe hot water heating system. Radiation throughout most of the house was Type R cast-iron baseboard located along the exposed wall in each room. Small tube, 22-in. high radiators were used in the vestibule, lavatory, stair landing, and bath.

The chimney to which the gas-fired boiler was connected had a height of 35 ft 2 in. above the basement floor and consisted of a $6\frac{1}{2}$-in. × 11-in. fireclay flue lining enclosed by one course of red brick. The smoke pipe connection was 7 ft 1 in. above basement floor level, and the draft hood was at an elevation of 5 ft 8 in. The chimney extended up through the central part of the house and was completely surrounded by heated space from its base to the level of the second-story ceiling. The plaster walls were separated from the masonry by an air space averaging about 5 in. in width. At the second story and basement ceiling levels this space was packed with mineral wool to decrease the circulation of air between the space around the chimney and the attic or basement. Another chimney of identical measurements and similar construction, but located on an exterior wall, was used for a gas water heater.

There were 2 fan-coil units, one on each story, used for summer cooling. These units were supplied with chilled water from an air-cooled chiller located outside the house. The units were centrally located with a supply register 4 in. from the ceiling of each room. The return grille on the first story was located in the living room next to the stairs. The second floor return was in the hall. These units were used to distribute helium through the house in both summer and winter tests.

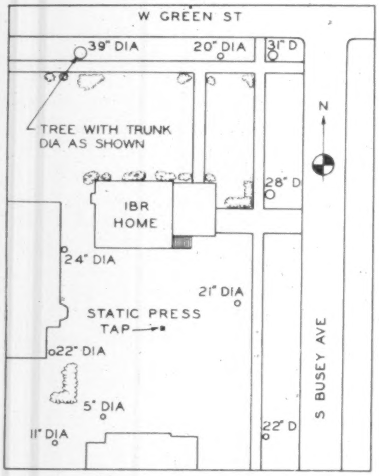

Fig. 2—Site plan for the I=B=R Research Home

Instrumentation for determining infiltration consisted of a helium gas analyzer, a valve manifold panel and sampling tubes. A schematic diagram of the helium analyzer and the manifold panel is shown in Fig. 3. The principle of operation of the analyzer was the same as the one used by J. B. Dick[3]. The sampling tubes, which were $\frac{1}{4}$-in. OD copper tubing, were located as shown in Fig. 1, with inlets 60 in. above the floor in the first and second story rooms. The inlet of the attic tube was 6 in. above the joist, and that in the basement was 15 in. below the floor joists. The sampling tube in the second story hall could be moved to various locations.

Instrumentation for a study of the neutral zone location consisted of 7 differential pressure gages and one recorder, all readable to within ±0.002 in. of water. These gages were connected to outdoor total pressure taps located as shown in Fig. 1. One side of each gage was open to the room. The outdoor total pressure taps consisted of a 3/32-in. OD aluminum tube which extended through a window mullion. The end of the tube was flush with the face of a small octagonal aluminum plate mounted against the mullion and parallel to the glass. The indoor-outdoor recorder measured the static pressure difference at the first-story floor level. The outdoor static pressure tap for the recorder was located 32 ft south of the house and 6 in. above the ground. The outdoor static pressure was taken from the center of the inner surface of two 12 in. square plates mounted horizontally $\frac{1}{4}$ in. apart.

Warm-Air Heating Research Residence No. 2: Research Residence No. 2 was a one-story frame structure with full basement. A detailed description has been presented[5] in University of Illinois Engineering Experiment Station *Bulletin 401*. Total volume of the first story was 8084

Table 1—Equivalent[a] crackage of first and second stories of the I=B=R Research Home

Room	Total Length of Crack, ft			
	S	W	N	E
First Floor				
Liv. Room			37.2	
Hall			14.8	45.0
Lavatory				8.9
Kitchen	27.0			9.0
Dining R.	73.6	18.6		
Second Floor				
Bedrooms				
SW	17.8	17.8		
NE			17.8	15.9
NW		15.9	17.8	
Hall				15.9
Bath	15.9			
Total	134.3	52.3	87.6	94.7

[a] Average width of crackage for weatherstripped windows was assumed to be 0.04 in. and for weatherstripped doors, a value of 0.09 in. was assumed. Crack lengths are given in terms of an 0.04 in. crack.

cu ft, including closets. Basement volume was 8890 cu ft. Walls were insulated with 3⅝-in. mineral wool blanket insulation with vapor barrier attached. The ceiling was fully insulated, and the attic space was vented by louvers in the gable ends and 1-in. slots in the eave overhang on the south and north exposures. All windows were of the horizontal sliding type, with weatherstripping, except the fixed picture window in the living room. The Residence was equipped with storm windows and storm doors during heating studies, but summer studies were made with the storm windows and doors removed. Removal of the storm windows would have no effect on the infiltration rates through the windows since they were fastened directly to the window sash. Since the doors were weatherstripped and well fitted, the change in the infiltration rate through the doors would also be small. Crackage in each exposure expressed in terms of the crack width of weatherstripped windows is listed in Table 2. The Residence was located on a comparatively open site, remote from buildings and trees. The nearest structures were a one-story weather station about 40 ft to the north, a one-story bungalow about 80 ft northeast and a row of one-story flat-roofed bungalows about 120 ft to the south.

During winter studies the Residence was heated by a gas-fired forced warm-air furnace. The furnace chimney was constructed of prefabricated cement-asbestos sectional units 8 in. in diameter. The total chimney height was 26 ft 11 in. above the basement floor; the 5-in. flue connection was at an elevation of 6 ft 9½ in.; and the opening to the furnace draft hood was at a height of 4 ft 3 in. above basement floor. A separate 4-in. diameter chimney of cement-asbestos material was provided for the gas-fired water heater.

Table 2—Equivalent[a] crackage of first story of Research Residence No. 2

Room	Total Length of Crack, ft			
	S	W	N	E
Living Room	100.0			
S. Bedroom	25.0	21.5		
Bath		14.5		
N. Bedroom		25.0	22.5	
Hall			45.0	
Kitchen-Din.			41.5	17.0
Total[b]	125.0	61.0	109.0	17.0

[a] Average width of crackage for weatherstripped windows was assumed to be 0.04 in. For fixed window a value of 0.02 in. and for weatherstripped doors a value of 0.09 in. was assumed.

[b] The sum of the maximum crackages of each room was 251 ft.

During the early part of the summer a water-cooled condensing unit was used to cool the Residence. This unit was later replaced by a self-contained air-cooled condensing unit. Outdoor air was supplied to the air-cooled condenser through a 14- × 20-in. duct, and the heated air was returned to the outdoors through a duct of the same size. A basement window was replaced by a plywood panel with openings for the condenser air ducts. The cracks between the ducts and the plywood panel and between the window frame and the plywood panel were sealed with caulking compound.

Instrumentation for these studies consisted of a helium gas analyzer, a valve manifold panel and sampling tubes (see Fig. 3). The sampling tubes, which were ¼-in. OD copper tubing, were located as shown on Fig. 4. The sampling tubes extended 60 in. above the floor in the first-story rooms, and that in the basement was 4 in. below the floor joists. The sampling tube in the return-air duct was about 1 ft below the return-air grille.

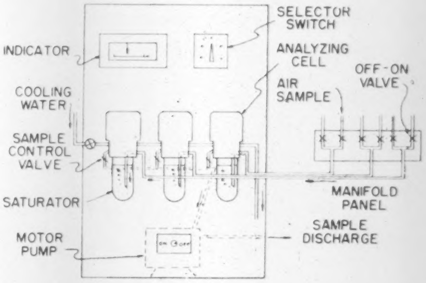

Fig. 3—Schematic diagram of helium analyzer and manifold panel

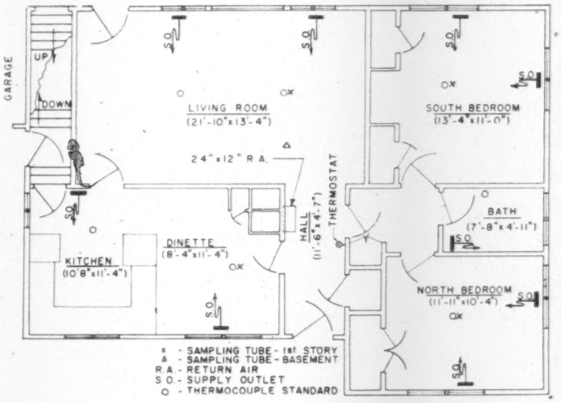

Fig. 4—Floor plan of warm air heating Research Residence No. 2

To obtain indoor-outdoor pressure differentials during the investigation, a static pressure tube[6] was located 6 ft 2 in. above the roof peak and a static pressure tap, made of ⅛-in. iron pipe, was located at the floor level in the living room. Instantaneous values of pressure differential were measured by an inclined draft gage and a continuous record was obtained by a draft recorder. The tube connecting the outdoor static pressure tap to the measuring instruments was exposed to outdoor temperature throughout its length to the point of entry into the basement at the first-story floor level. Hence, the indicated pressure differential was nearly equal to the indoor-outdoor pressure differential at the first-story floor level.

Test Procedure and Special Tests

Helium Release: Introduction of helium into the first and second story rooms of the Research Home was accomplished by releasing helium into the return-air plenum of each fan-coil unit through a ⅜-in. OD copper tube with 4 rows of 3/32-in. diameter holes spaced on 1½-in. centers. During the release of helium, a pressure of 10 psig was maintained in the release tube. The helium was then distributed directly into the rooms by the unit fans. The second-story rooms received the helium first. In order to give an initial concentration of about 1.3 percent, 125 cu ft of helium was released, which required about 8 min.

In Research Residence No. 2 helium was released into the return-air plenum of the warm-air heating system and drawn through the filter into the furnace casing and forced through the air distribution system into the individual rooms. The volume released was adjusted to give an initial volumetric concentration of helium in the first-story rooms of about 1.3 percent. The time required for admitting this amount of helium (approximately 110 cu ft) was about 5 min.

Air-Helium Samples: Air-helium samples were drawn from each station through the sampling tubes, through the manifold panel, and thence to one of the 3 saturators by a pump. Samples were saturated by being bubbled through distilled water in the saturator. Thermal conductivity of the saturated air-helium sample was compared with that of a saturated air sample in the analyzer cell and was then discharged through a ¼-in. OD copper tube into the kitchen of the I=B=R Research Home. The small quantity of helium discharged had a negligible effect on the *apparent* kitchen air change rate. In Research Residence No. 2 the air-helium samples were discharged into the return-air duct downstream from the sampling station.

Test Conditions and Data Taken: (*a*) *I=B=R Research Home*: All windows and exterior doors were closed during each test except the kitchen door leading to the basement and the outside basement door, which were opened several times during tests. The house was occupied by 2 to 5 persons, and all cabinets, drawers, and closets were opened throughout each test. During several special tests the second story was sealed off from the first.

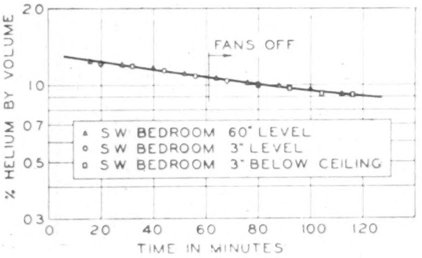

Fig. 5—Rate of decay of helium for three elevations in the SW bedroom of I=B=R Research Home

Concentration of helium at each of the sampling stations was measured at 12 min intervals. Concurrent with the readings of helium concentration, indoor and outdoor temperature and humidity, and indoor-outdoor pressure differences at 8 locations were recorded. Wind speed and direction were obtained from the University Weather Station, located in a residential area similar to that of the Research Home. Wind velocity and direction were measured 15 ft above the roof of a 2-story building. Duration of the tests was from 1 to 1½ hours.

(*b*) *Warm-Air Heating Research Residence No. 2*: During each study all outside doors and windows were closed. The blower was operated continuously to assure uniform mixing of the air and helium in the rooms, and operation of the gas burner or the refrigeration compressor was controlled by the thermostat on the first story. During most of the studies the living quarters were not occupied. All cabinets, drawers, and closets were closed throughout each test except during 2 special studies made with closets open.

Concentration of helium at each of the sampling stations was measured at 6 min intervals. Wind velocity and direction, indoor and outdoor temperature and humidity, velocity pressure and draft in the smoke pipe, and the indoor-outdoor pressure difference were recorded during each test. Wind velocity and direction were measured at the weather station located 40 ft north of the Residence. The anemometer and direction indicator were located approximately 23 ft above ground level. Duration of the tests varied from 1½ to 2 hr.

Distribution Tests: The rate of infiltration determined by the tracer gas technique is valid only when the tracer gas is uniformly distributed in the room. British studies[2] have shown that erroneous *apparent* air change rates could be obtained due to stratification of the tracer gas. Since helium is considerably lighter than air, the validity of taking samples at one point in each room was questioned and several distribution tests were run in each of the houses.

Helium concentration was measured at various levels and in corners of 2 rooms in the I=B=R Research Home. Fig. 5 shows results of a test in the southwest bedroom where the concentration was measured at 3 levels — 3 in., 60 in., and 7 ft 6 in. There was practically no difference in concentration at any of these levels, and even after the fans were turned off there was excellent agreement. Since this test was conducted in August, the question of room temperature gradients may arise. However, during summer cooling the gradients were as severe as during winter heating.

Similar results were obtained in Research Residence No. 2. During each study, however, the fan was operated continuously, and no attempt was made to determine the amount of stratification with the fan off.

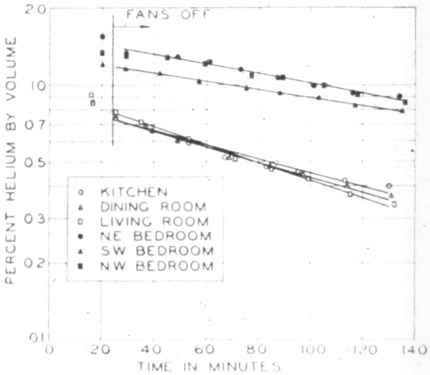

Fig. 6—*(left)* Rate of decay of helium with fans not operating in the I=B=R Research Home

In the studies in Research Residence No. 2 it was observed that the helium decay curves, when plotted on semi-logarithmic paper, deviated slightly from the predicted straight-line relationship. This deviation was attributed to leakage of helium into the closed closets and exterior walls and to absorption by furnishings.

To determine the effect of closets on the decay of helium concentration, several studies were made with the closets opened but with the drawers and cupboards closed. Comparison of the data obtained on similar days with and without the closets closed showed that similar deviations occurred. From this it was concluded that the effect of the closets was not the dominant cause of the observed deviation.

House Stack Effect Test: When temperature difference is the only force causing infiltration there is a flow of air into a building near the ground level and out at a higher elevation; this flow reverses when there is a higher temperature outside the building than inside. Flow of air between the first and second stories in the Research Home was studied by placing a seal between the 2 stories, injecting helium into one story and allowing it sufficient time to mix well, then removing the seal and noting the changes in helium concentration throughout the house.

When helium was released on the second story very little ever reached the first story after removing the seal, but when helium was added initially to the first story a rapid increase was noted on the second story after removing the seal. The results show that most but not all air change between first and second stories was upward during the heating season.

Results

I=B=R Research Home: If it is assumed that the decay of helium concentration per unit time for the whole Research Home is equal to the helium leaving the Home with the exfiltrating air in the same unit time, then

$$V\,dc = n\,V\,c\,dt$$

where

V = house volume.
c = instantaneous concentration of helium.
n = number of air changes per unit time.
t = time.

the equation when solved gives

$$n = 1/(t_2 - t_1)\ ln\ (c_1/c_2)$$

or equivalently $c_2 = c_1 e^{n} (t_2 - t_1)$

Thus, on semi-logarithmic paper the decay curves will be straight lines, the slopes of which are directly proportional to the infiltration rate. Typical decay curves for the first and second-story rooms of the Research Home are shown in Fig. 6. Except for the mixing period, 20-30 min, the points fell very close to straight lines. There was some deviation which may be partly attributed to helium leaking into walls, furniture, and similar places when the concentration was high and then returning to the room air when the concentration had decreased.

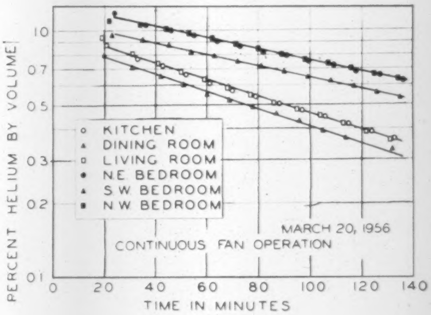

Fig. 7—*(right)* Rate of decay of helium with continuous fan operation in the I=B=R Research Home

The steep living room decay curve was the result of several factors. The vestibule, with a large amount of crackage area, opened directly into the living room. This condition was accentuated when the heating plant was in operation because of the removal of air from the basement through the chimney. Basement air was partly replaced by first story air leaking through cracks around the kitchen door leading to the basement. This caused a greater air change on the first story than when the chimney was cool. The same reasoning can be applied to the dining room in view of the large crackage area there also.

Varying slopes of decay curves in a single story occurred only when the house air was relatively still. Fig. 7 shows that when the fans were operated continuously the slopes of decay curves on any one story were approximately the same. One sampling tube on each story would have given accurate results with the fans in operation. However, provided there is no helium stratification, still air conditions within the house will give a more accurate account of infiltration in individual rooms than when the air is stirred by fans. The slopes of the decay curves for the 2 stories shown in Figs. 6 and 7 should not be interpreted to mean that the infiltration in the first story is greater than that of the second story. The movement of helium-laden air from the first to the second story would cause the *apparent* air change of the second floor to be less than the actual air change rate.

The infiltration rate for the Research Home was increased very slightly when the fans were operating. This was due to leakage of air from the second story fan unit plenum into the attic. For this reason all test results given here are with fans not operating.

Table 3 gives a summary of the weather conditions during each test. The indoor-outdoor static pressure difference at the first-story floor level and the location of the neutral zone above the first-story floor level are also given; these values have been omitted for the last 4 tests because of inaccuracy of the pressure measuring instruments. The pressure difference and neutral zone for test No. 10 are questionable for the same reason.

Infiltration rates of the house and individual rooms for all tests are given in Table 4. The rates for the house and rooms were omitted for several tests because they were not representative of actual infiltration rates.

Warm-Air Heating Research Residence No. 2: The procedure followed in the analysis of the data obtained in Research Residence No. 2 was the same as that just outlined. The number of air changes at each of the sampling stations on the first story was obtained from the slopes of the helium decay curves plotted on semi-logarithmic paper. A summary of the weather conditions during each test is given in Table 5, and the air change rates calculated from the decay of helium concentration during each test are tabulated in Table 6. The average air change rates listed in Table 6 were computed as the summation of the individual air change rates weighted with respect to room volume. Since the weighted average rate and that measured in the return-air duct differed by only a small amount, the data observed in the return-air duct have been used to represent the air change rate of the entire first story.

Tests 1 through 14 in Table 5 were taken during the heating season and with the exception of Test

Table 3—Summary of test conditions — I=B=R Research Home

Test No.	Date	Temperature		In-Out Temp. Diff., F	Avg. Wind Velocity, mph	Max. Wind Gust, mph	Wind Direction	In-Out Press. Diff., in. H_2O	Neutral Zone from First Floor, in.
		Indoor F	Outdoor F						
1	2-10-56	75	28	47	4	13	S	−0.018	164
2	2-28-56	75	24	41	8.5	15	NW	−0.018	155
3	3- 3-56	73	51	22	7	23	N	−0.015	167
4	3- 8-56	73	25	48	13	27	W	−0.021	169
5	3-15-56	73	39	34	9	17	NE	−0.013[a]	160[a]
6	3-20-56	73	42	31	6	15	S	−0.014[a]	139[a]
7	4-10-56	73	46	27	9.2	20	E	−0.012[a]	145[a]
8	4-16-56	73	43	30	9.7	34	NW	−0.017	158
9	4-19-56	74	61	13	8.3	21	N	−0.009	122
10	5- 3-56	74	70	4	5.5	15	S	−0.005	115
11	6-27-56	76	83	−7	9.5	22	W	..	..
12	7- 5-56	76	71	5	6.2	12	NW	..	..
13	8- 6-56	77	82	−5	7.5	19	N	..	..
14	8-14-56	75	84	−9	6.7	17	N	..	..

[a] Data not shown in Figures.

Table 4—Summary of measured infiltration rates — I=B=R Research Home

Test No.	No. of Air Changes Calculated from Tests						
	Liv. Rm.	Din. Rm.	Kitch.	NE Bed.	NW Bed.	SW Bed.	House[d]
1	0.43	0.33	0.29	0.27	0.26	0.24	0.32
2[a]	Special Test						0.38
3[b]	Special Test						0.35
4[b]	Special Test						0.43
5[a]	Special Test						..[e]
6[c]	0.48	0.47	0.44	0.31	0.31	0.31	0.40[e]
7[c]	0.08	0.07	0.09	0.34	0.32	0.32	0.26[e]
8	0.35	0.25	0.33	0.38	0.42	0.38	0.35
9	0.32	0.24	0.29	0.25	0.26	0.27	0.28
10	0.12	0.17	0.15	0.15	0.14	0.33	0.17
11	0.10	0.10	0.11	0.19	0.24	0.22	0.16
12	0.13	0.22	0.18	0.25	0.28	0.21	0.20
13	0.12	0.17	0.28	0.23	0.12	0.16	0.16
14	0.17	0.20	0.43	0.14	0.08	0.16	0.17

[a] *Special Test* — House stack effect test with helium release on first story.
[b] *Special Test* — House stack effect test with helium release on second story.
[c] *Special Test* — Continuous fan operation during test.
[d] The house air change rate was computed from a weighted average of the room rates.
[e] Data not shown in Figures.

Table 5—Summary of test conditions—Research Residence No. 2

Test	Date	Temperature		In-Out Temp. Diff., F	Avg. Wind Velocity, mph	Max. Gust, mph	Wind Direction	In-Out Press., Diff., in. H_2O
		Indoor F	Outdoor F					
1	12-22-54	73.4	32.0	41.4	9	15	SSW	−0.001
2	12-28-54	73.5	32.0	41.5	10.5	21	N	0.003
3	1-11-55	73.4	31.4	42.0	5	10	SSE	−0.012
4	1-14-55	73.8	32.0	41.8	12	29	S	−0.008
5	1-28-55	73.9	3.9	70.0	7	11	WNW	−0.010
6	2-10-55	74.6	20.6	54.0	14	28	NNW	0.028
7	3- 2-55	74.7	55.2	19.5	8	17	SSE	0.006
8	3- 7-55	73.3	24.7	48.6	8	20	WSW	0.006
9	3- 8-55	74.4	60.0	14.4	15	27	WSW	0.027
10	3- 9-55	74.9	64.8	10.1	13	22	WSW	0.024
11	3-14-55	73.8	64.2	9.6	10	21	SSE	0.010
12	3-17-55	73.0	32.4	40.6	5	8	SE	−0.008
13	5- 6-55	77.8	80.8	− 3.0	8	17	S	0.010
14	5-19-55	80.0	72.0	8.0	3	5	W	−0.001
15	6-29-55	75.4	86.1	−10.7	7	15	SSW	0.011
16	7- 8-55	75.1	93.7	−17.6	8	20	SW	0.016
17[a]	7-20-55	75.0	87.0	−12.0	5	13	E	0.008
18[a]	7-21-55	77.7	89.9	−12.2	4	8	SE	0.007
19[a]	7-25-55	78.2	87.5	− 9.3	4	13	S	0.005
20[a]	7-26-55	76.2	93.5	−17.3	5	10	SW	0.009
21[a]	8- 5-55	76.2	86.9	−10.7	5	9	SW	0.007
22[a]	8- 5-55	76.0	88.0	−12.0	5	12	SW	0.008
23[a]	8- 8-55	75.0	76.2	− 1.2	5	11	SE	0.005

[a] Tests 17 through 23 were made with self-contained air-cooled condensing unit installed in Residence. Leakage of condenser air to recirculation air passage increased infiltration and tests have not been used in analysis.

Table 6—Summary of measured infiltration rates—Research Residence No. 2

Test No.	No. of Air Changes Calculated from Tests						Notes
	N BRm	Din Rm	S BRm	Liv Rm	Return	Ave.	
1	0.59	0.56	0.56	0.55	0.57	0.56	
2	0.57	0.54	0.54	0.56	0.54	0.55	
3	0.54	0.50	0.49	0.52	0.53	0.52	
4	0.63	0.59	0.60	0.60	0.63	0.60	
5	0.93	0.76	0.77	0.78	0.80	0.80	
6	0.62	0.54	0.59	0.56	0.60	0.57	
7	0.45	—	—	0.32	0.33	—	
8	0.50	—	0.50	0.50	0.49	—	
9	0.48	0.38	0.43	0.38	0.40	0.41	
10	0.41	0.38	0.40	0.36	0.38	0.37	
11	0.32	0.34	0.36	0.31	0.36	0.33	
12	0.41	0.39	0.44	0.41	0.44	0.41	
13	0.27	—	0.27	—	0.28	—	
14	0.28	0.26	0.27	0.25	0.26	0.26	
15	0.36	0.32	0.37	0.34	0.33	0.34	1
16	0.38	0.36	0.38	0.37	0.36	0.37	2
17[a]	0.59	0.54	0.52	0.54	0.51	0.54	3
18[a]	0.63	0.64	0.64	0.64	0.64	0.64	4
19[a]	0.37	0.36	0.37	0.36	0.37	0.36	5
20[a]	0.45	0.43	0.43	0.42	0.42	0.43	3
21[a]	0.63	0.56	0.56	0.56	0.56	0.57	6
22[a]	0.33	0.34	0.37	0.34	0.37	0.35	3
23[a]	0.34	0.37	0.35	0.37	0.36	0.36	7

[a] These studies were not included in comparisons with the winter data.

Notes: 1—Water-cooled, unit off; 2—Water-cooled, unit on; 3—Air-cooled, unit on; 4—Air-cooled, unit off, closets open; 5—Air-cooled, duct sealed, closets open; 6—Air-cooled, unit off; 7—Air-cooled, duct sealed

13 the indoor temperature was greater than that outdoors. Tests 15 through 23 were taken during a summer cooling investigation when the indoor temperature was less than that outdoors.

Of the 9 tests conducted during the summer, only the first 2 have been included in the results. The last 7 tests, which were made with the self-contained air-cooled condensing unit installed, have been omitted because of increased infiltration resulting from leakage of outdoor air used for condensing into the recirculated room air. The condition of the air-cooled unit during each of the 7 tests is given in the last column of Table 6.

Summary

1. The Research Home, which was located on a typical city site surrounded by large trees and houses, had a considerably smaller infiltration rate at a given wind velocity measured above tree top level than that of Research Residence No. 2, which was located on a relatively open site, free of trees, and typical of new housing developments.

2. The helium tracer gas technique could be utilized for field measurements of infiltration in a variety of houses, thus providing much needed information on the application of laboratory data to actual construction. In houses equipped with warm-air heating systems, a single helium analyzing cell located in the total return-air stream would provide satisfactory indication of the house infiltration rate. In houses equipped with hot water or steam heating systems, a single cell located on each floor would give satisfactory results provided some means were used to keep the room air well mixed.

Acknowledgments

Acknowledgment is made to the *Institute of Boiler and Radiator Manufacturers* and to the *National Warm Air Heating and Air Conditioning Association* for permitting their respective research staffs to participate in these studies and for allowing the studies to be conducted in their experimental houses.

The authors wish to thank H. Hagan, formerly visiting scholar from Norway, and C. F. Chen, formerly research assistant in Mechanical Engineering, for the collection and analysis of much of the data obtained in Warm-Air Heating Research Residence No. 2. The authors also wish to thank F. J. Poskocil, student assistant, for the collection of much of the data obtained in the I=B=R Research Home and for preparing many of the drawings in this paper.

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6. Outdoor Air Supply and Ventilation of Furnace Closet Used with a Warm-Air Heating System, by R. W. Roose, N. A. Buckley and S. Konzo (Engineering Experiment Station *Bulletin No. 427*, University of Illinois, Urbana).

NOTICE OF SEMI-ANNUAL MEETING 1957

Please take notice that the Semi-Annual Meeting 1957 of the American Society of Heating and Air-Conditioning Engineers will take place in the Manoir Richelieu, Pointe-au-Pic (Murray Bay), P.Q., Canada, beginning at 2 p.m. on Monday, June 24, 1957. The attention of the membership is called to the program of the meeting appearing on page 173.

There will be six technical sessions including a Symposium on Air-Conditioning Instrumentation and one on Sound and Vibration. Fourteen papers will be presented at the sessions.

By-Law amendments proposed and subscribed to by the Council will be presented, as per Article IX of the By-Laws. The purpose of the amendments is to revise membership grades and enlarge Council committees.

If you have not already made reservations for hotel accommodations and transportation to Murray Bay, this should be given immediate attention.

P. B. GORDON
President

A. V. HUTCHINSON
Executive Secretary

May 16, 1957

Murray Bay Ahead for Semi-Annual Meeting

June 24-26, 1957
Manoir Richelieu
Murray Bay, Canada

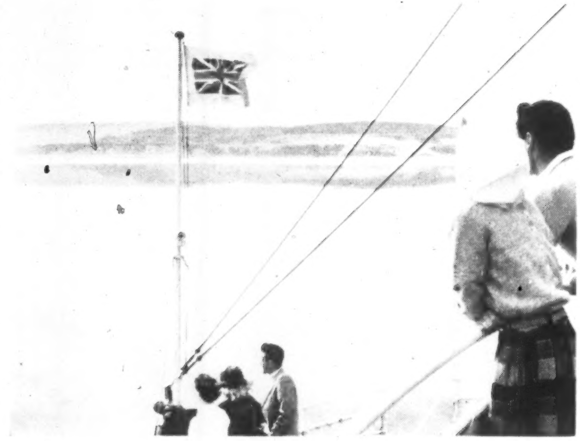
Pres. P. B. Gordon, New York, N. Y., will officially call the First Session to order at the Semi-Annual Meeting of the Society at 2:00 p.m. on Monday afternoon, June 24, and simultaneously the Second Session will be called to order by 1st Vice Pres. E. R. Queer, University Park, Pa.

There will be 6 sessions with the Semi-Annual Meeting adjourning at the conclusion of the last session on Wednesday at noon. The total of 14 papers and 2 symposiums will be presented.

The Executive Committee (E. R. Queer, chairman) and the Regions Central Committee (A. J. Hess, chairman) will meet on Saturday afternoon. Sunday there will be meetings of the Finance Committee (Walter A. Grant, chairman) and the Research Executive Committee (H. A. Lockhart, chairman). The Council will meet at 1:30 p.m., with Pres. P. B. Gordon presiding.

Several Technical Advisory Committees will meet Sunday evening and Monday morning. TAC on Insulation (M. W. Keyes, chairman) and TAC on Plant and Animal Husbandry (A. J. Hess, chairman) will meet Sunday evening. TAC on Air Cleaning (E. F. Snyder, Jr., chairman), TAC on Air Distribution (W. O. Huebner, chairman) and the TAC on Sorption (G. L. Simpson, chairman) will hold meetings Monday morning. The Nominating Committee will meet Monday evening at 8:00 p.m.

Tuesday afternoon the ASHAE Golf Tournament will be held on the championship Manoir Richelieu golf course with members competing for the Past Presidents' Research Bowl, Chapters competing for the Eichberg Memorial Cup, and the high gross scorer of the day receiving the Paul Bunyan Trophy.



The trophies will be awarded at the Semi-Annual Banquet on Tuesday evening. The Banquet is *the* social event of every Society Meeting and Murray Bay is no exception. Montreal Chapter's Committee on Arrangements, D. Lorne Lindsay, chairman, successfully invited a much sought after speaker to deliver the banquet address.

He is Dean David L. Thomson, vice principal of McGill University, Montreal. Dean Thomson, who is a member of many scientific and medical boards, possesses a wide knowledge and a keen sense of humor.

The members of the Committee on Arrangements are: F. Aylmer Hamlet and G. Lorne Wiggs, honorary chairmen; D. Lorne Lindsay, general chairman; W. G. Hole, B. J. Horsburgh, R. J. Ker, and H. G. S. Murray, vice chairmen; and the following subcommittee chairmen: Reception and Registration — G. Lorne Wiggs (honorary) and Cliff Lynch; Ladies — Mrs. A. E. Horsburgh; Children — J. P. Fitzsimons; Transportation and Hotel Reservations — W. E. Jarvis; Finance — F. G. Phipps (honorary) and Ralph Grossman; Banquet — Leo Garneau; Entertainment — G. N. Martin and W. G. McCrudden; Golf — W. J. McAdam; Publicity — W. U. Robinson; Sessions — Eric Williams and Marcel P. F. Turnau.

Method of Choosing Location of, Financing and Conducting Meetings of the Society

Resolved: That inasmuch as the Annual and Semi-Annual Meetings of the Society come under the jurisdiction of the Council, the following rules governing the handling of such meetings be adopted by the Council and published in the JOURNAL of the Society at least twice during every year, preferably just prior to each meeting.

1—The Council will select the city in which the Annual or Semi-Annual Meeting is to be held, giving due consideration to the invitations received from Chapters or members as well as to the advisability of so distributing those meetings as to make them of the greatest advantage to the general membership, and to reduce as far as possible the expense of members attending.

2—That an appropriation be made to cover the entertainment or local expenses, incurred in connection with the meeting, and the regular meeting expenses to be taken care of by the General Fund of the Society in the regular way.

3—That no registration fee or compulsory obligations of any nature be imposed on members or guests.

4—That the purchase of tickets for banquets or for any other form of entertainment that may be provided be entirely voluntary.

5—That the grouping of features and the sale of tickets for group features be discouraged.

6—That the raising of funds from manufacturers of heating apparatus be discouraged.

7—That the display of samples, or of literature, advertising the product of any manufacturer in any way, shape or form, be not permitted at the booths, registration desk, or in or about the meetings.

8—That the distribution of trade papers be entirely at the discretion of the committee in charge.

9—That the local Chapter or local members be empowered to form a General Committee with such sub-committees as may be required to handle the details of transportation, hotel accommodations, entertainment, finance, etc., and that this General Committee be requested to confer frequently with the Council, through the Executive Secretary of the Society, and to make frequent reports on progress in connection with the various matters being handled by them.

10—That the arrangements of elaborate and costly entertainment features be discouraged.

Adopted at Council Meeting, January 29, 1926.

Program

Manoir Richelieu **Semi-Annual Meeting, Murray Bay, Que., Canada** **June 24-26, 1957**

Saturday — June 22

1:30 p.m. Executive Committee, E. R. Queer, *Chairman*

3:30 p.m. Regions Central Committee, A. J. Hess, *Chairman*

Sunday — June 23

9:30 a.m. Finance Committee, Walter A. Grant, *Chairman*

10:00 a.m. Lawn Bowling for Ladies

10:00 a.m. REGISTRATION

1:30 p.m. Council Meeting

2:00 p.m. Research Executive Committee

3:30 p.m. Welcome Tea

8:00 p.m. TAC on Insulation, M. W. Keyes, *Chairman*

8:00 p.m. TAC on Plant and Animal Husbandry, A. J. Hess, *Chairman*

9:00 p.m. Movies

Monday — June 24

9:00 a.m. TAC on Air Cleaning, E. F. Snyder, Jr., *Chairman*

9:00 a.m. TAC on Air Distribution, W. O. Huebner, *Chairman*

9:00 a.m. TAC on Sorption, G. L. Simpson, *Chairman*

9:30 a.m. REGISTRATION

10:00 a.m. Lawn Bowling for Ladies

2:00 p.m. FIRST SESSION

Call to Order — Pres. P. B. Gordon

Greetings by D. Lorne Lindsay, Chairman, Committee on Arrangements

Thermal Circuit Analysis for Developing Application Engineering Information, by S. F. Gilman and O. W. Clausen

Thermal Performance of Frame Walls, Part III — Wall Surface Temperatures, by G. O. Handegord

Saturation Pressure of Water on the New Kelvin Temperature Scale, by J. A. Goff (by title only)

2:00 p.m. SECOND SESSION

Call to Order — 1st Vice Pres. E. R. Queer

SYMPOSIUM ON AIR-CONDITIONING INSTRUMENTATION

C. H. Pesterfield, Symposium Chairman
R. N. Pond, Moderator

The Fundamentals of Commercial Controls — V. Robert Baird

Control of High Velocity Single Duct Systems — W. G. Young

Control of High Velocity Double Duct Systems — H. W. Alyea

Coordination of High Velocity Design — L. F. Flagg

2:30 p.m. Ladies Fashion Show and Tea

7:00 p.m. Buffet Supper — Habitant Evening — Dancing

8:00 p.m. Nominating Committee

Tuesday — June 25

9:00 a.m. REGISTRATION

9:30 a.m. THIRD SESSION

Call to Order — 2nd Vice Pres. A. J. Hess

TOPICAL SESSION ON SOUND AND VIBRATION

H. A. Lockhart, Chairman

Equipment for Room Noise from Air Conditioning — C. M. Ashley

An Evaluation of Four Methods for Determining the Sound-Power Output of a Fan — W. F. Kerka

Acoustic Power Level Determination for Machinery in Hard Rooms — W. J. Burch

Studies in Silencing a Diesel Driven Heat Pump — H. H. Vickers and R. W. Sage

9:30 a.m. FOURTH SESSION

Call to Order — Treas. C. H. Pesterfield

Acoustic Coupling of Residential Furnaces with their Surroundings, by C. F. Speich, W. R. Dennis and A. A. Putnam

Performance of Intermittently-Fired Oil Furnaces, by W. G. Colborne

Measurement of Infiltration in Two Residences, Parts I and II, by D. R. Bahnfleth, T. D. Moseley and W. S. Harris

Design and Performance of a Portable Infiltration Meter, by C. W. Coblentz and P. R. Achenbach

10:00 a.m. Ladies Putting Contest

1:30 p.m. Golf Tournament

2:00 p.m. Sightseeing Tour

7:00 p.m. BANQUET

Toastmaster: F. Aylmer Hamlet

Speaker: David L. Thomson, Dean of Faculty of Graduate Studies and Vice Principal, McGill University

Subject: "Welcome to Canada"

Presentation of Golf Trophies: Past Presidents' Research Bowl; Eichberg Memorial Cup; Paul Bunyan Cup

Wednesday — June 26

9:30 a.m. FIFTH SESSION

Call to Order — 1st Vice Pres. E. R. Queer

SYMPOSIUM ON SOUND AND VIBRATION

John Everetts, Jr., Symposium Chairman

J. B. Graham, Moderator

Noise Control Problems and Air-Conditioning Equipment — R. J. Wells

Techniques of Sound Power Level of Unitary Equipment — R. N. Hamme

Sound Standards for Testing and Rating — H. C. Hardy

Application of Standards to Equipment — R. E. Parker

A Method for Estimating Octave Band Level of Noise Generated by Air-Conditioning Systems — F. B. Holgate and Sidney Baken

9:30 a.m. SIXTH SESSION

Call to Order — Pres. P. B. Gordon

Performance Testing of Roof Ventilators, by J. J. Wannenburg

Jet Velocities from Radial Flow Outlets, by Alfred Koestel

Velocities and Temperatures on Axis of Downward Heated Jet from 4-Inch Long-Radius *ASME* Nozzle, by Rudiger Knaak

Report of Resolutions Committee

Unfinished Business

New Business

Adjournment

10:00 a.m. Ladies Handicraft Exhibition Demonstration

Journal Section

WALLACE AT NORTH CAROLINA UNIVERSITY INAUGURATION

W. M. Wallace II, Durham, N. C., by appointment of Pres. P. B. Gordon, New York, N.Y., represented the Society at the Inauguration Ceremony on Wednesday, May 8, when William Clyde Friday was inducted as president of the Consolidated University of North Carolina.

REGION 5 MEETING AT NEW ORLEANS

The Chapters Regional Committee meeting of Region 5 was held May 2 at the Roosevelt Hotel, New Orleans, La., with Regional Director C. B. Gamble presiding. More than 30 attended the meeting, including officers, members of Council, regional committee members and guests. J. H. Maloney of the Delta Chapter was elected secretary.

Among those in attendance, besides Delta Chapter Pres. H. N. Stall and Mr. Maloney, were Pres. P. B. Gordon, 1st Vice Pres. E. R. Queer and 2nd Vice Pres. A. J. Hess; Members of Council John Everetts, Jr., P. J. Marschall, P. N. Vinther, J. H. Ross, B. W. Farnes, D. M. Mills, A. B. Algren, and W. O. Stewart. The following members and alternate members of the Chapters Regional Committee were present: J. H. Maloney, member, Delta Chapter; J. A. Marshall, member, Atlanta Chapter; W. J. Killian, member, and O. J. Hill, alternate member, Bluegrass Chapter; J. F. Naylor, Jr., member, and A. J. Mayers, Jr., alternate member, Baton Rouge Chapter; W. R. Robertson, Jr., member, Baltimore Chapter; D. F. Ingram, member, and F. H. North, alternate member, Mississippi Chapter; J. E. Hart, member, and C. E. Amick, alternate member, Northern Piedmont Chapter; W. P. Wells, member, and J. R. Clark, alternate member, Southern Piedmont Chapter; J. E. McMurray, member, South Carolina Chapter; D. C. Delinger, member, Virginia Chapter; and H. W. Rush, alternate member, Washington, D.C., Chapter. Also present were W. B. Martin, Jr., and W. B. Moses, Jr., members of the Delta Chapter.

During the luncheon meeting, at which Regional Director Gamble presided and President Gordon introduced the speaker, the group heard 1st Vice President Queer give an illustrated talk on *What Are Our Future Energy Sources.*

At an executive session of the Chapters Regional Committee in the afternoon, the group selected a member and first and second alternate to the nominating committee.

Some 150, including officers, Council members, Chapters Regional Committee members, members of the Delta Chapter, guests, and their wives, attended a gala French Quarter-style dinner at Arnaud's Restaurant.

Following the introduction of Society officers, Council members, and host chapter officers, President Gordon gave a brief talk.

LOCKHART ON B & G BOARD

H. A. Lockhart, Morton Grove, Ill., long a member of the Society and currently chairman of the Committee on Research, has been elected to the Board of Directors of Bell and Gossett Co. He will continue as vice president and chief engineer.

CORRECTION

Relative to paper presented at the 63rd Annual Meeting of ASHAE in Chicago, January 1957, "From '36 to '56: Air Conditioning Comes of Age," Walter A. Grant, the author, regrets the omission of three names in the caption to Fig. 10 (JOURNAL SECTION, *Heating, Piping & Air Condi-*

At dinner preceding Delta Chapter Meeting, May, 1957, at Arnaud's in New Orleans. *(l. to r.)* Mrs. Gordon, T. A. Stokes, Pres. P. B. Gordon, Mrs. A. F. Lusch, Mrs. Stokes

●

One of the sessions at the Chapters Regional Committee Meeting in New Orleans. *(l. to r.) Rear:* A. V. Hutchinson, J. H. Maloney, C. B. Gamble, P. B. Gordon, E. R. Queer, A. J. Hess. *Center:* C. E. Amick, J. E. Hart, D. F. Ingram, F. H. North, D. C. Delinger, J. A. Marshall, J. R. Clark, W. P. Wells. *Front:* W. G. Robertson, Jr., H. W. Rush, O. J. Hill, A. J. Mayers, Jr., J. F. Naylor, Jr., J. E. McMurray

tioning, January 1957, p. 196). The caption should have read:

This console room air conditioner (casing removed) of vintage 1933-37 was 20 years ahead of its time, featured a hermetic compressor and reverse cycle heating, and won for its development engineers, Henry L. Galson, Henry C. Heller, Charles R. Neeson, and Hans K. Steinfeld, the John Scott Medal awarded by the city of Philadelphia.

FITTS RECEIVES CONTRACTORS' ANNUAL SERVICE AWARD

J. C. Fitts

At the 68th Annual Convention of the *Mechanical Contractors Association of America* at Miami Beach, Fla. on May 9, ASHAE Pres. P. B. Gordon, New York, N. Y., presented the Distinguished Service Award for 1957 to Joseph C. Fitts, New York, N. Y.

This Award is in the form of a citation presented annually by the Association to a member who has contributed long and lasting service to the Mechanical Contracting Industry.

Mr. Fitts has rendered 38 years of loyal service to the Association. As secretary of the Association and editor of its *Official Bulletin*, his guidance through the years resulted in successful industry-wide standards for materials, equipment and data—Certified Pipe Welding Program—NRA Code on Fair Trade Practice—Apprentice Training Program—Certified Heating and so many other important efforts.

Since his retirement as national secretary, Mr. Fitts has continued his service to the industry as consultant to the National Association, as secretary of the National Certified Pipe Welding Bureau, and as a member of the National Joint Pipefitter Apprenticeship Committee. He continues his service in the field of education as president of the Vocational Board of Education of Bergen County, New Jersey.

Mr. Fitts is a member of *American Society of Association Executives*, Washington, D. C., and Life Member and past president of the *Trade Association Executives* in New York City.

A member of the Society since 1930, Mr. Fitts has always contributed generously of his time and effort in connection with various Society activities. Currently, he is a member of the Guide Advisory Committee.

CARTER HONORED IN WEBSTER GROVES

J. H. Carter, a member of the Society since 1936 and past president of the St. Louis Chapter, was honored recently by being named Webster Groves' Man of the Year for 1957.

Mr. Carter is at present a member of the City Council at Webster Groves, Mo., and was formerly vice chairman of its City Plan Commission. He has also been active in the American Red Cross and in Civil Defense for Greater St. Louis area.

ACTIVITIES OF SOCIETY CHAPTERS

Featured at recent Chapter meetings were Technical Talks, Tours, Panel Presentations, and Non-technical Programs. A number of chapters also schedule their Elections and Appointments for this time of year. Mention is made of individuals who were specially recognized by their chapters.

Technical Talks

School building was the subject of a presentation at an ARKANSAS Chapter meeting. C. S. Stock, manager, unit ventilator department, American Air Filter Co., Inc., Louisville, Ky., discussed heating and ventilating systems as applied to a school building of unusual design. A color film, entitled *Design for Living*, was shown. • • • Arkansas Chapter members also heard a technical discussion on the *Characteristics of Forced Hot Water Heating Systems*. The speaker was Frank Gall, manager, heat transfer department, Bell & Gossett Co., Morton Grove, Ill. • • • At a joint meeting of the ATLANTA Chapter of ASHAE and the Atlanta Chapter of *ASRE*, the guest speakers were William Turbeville and Charles Pridmore, Aluminum Company of America, Pittsburgh, Pa. They gave an informative presentation on aluminum foil insulation, using slides to show various methods of application with corresponding costs. • • • D. D. Wile, vice president in charge of engineering, Recold Corp., told the AUSTIN Chapter members and their guests *How to Design Air-Conditioning Systems to Avoid Muggy Conditions during Mild Humid Weather*. Mr. Wile stated that the proper way to reduce capacity is to reduce the temperature of the coil, and he proceeded to show how this could be done with on-off operation, multi-zone, multi-compressor, face damper, by-pass damper and split coil. His talk pertained to low load operations where the sensible heat is substantially reduced. Questions were asked throughout the talk, and the membership displayed an active interest in the subject. • • • At previous meetings, Austin Chapter members were privileged to hear other informative programs. Victor Cole, Carrier Corporation, Dallas, Tex., chose *The Automatic Absorption Machines* as his subject, and L. R. Charde, chief engineer, York Corp., Houston, Tex., described the rocket-testing refrigeration facilities at Inyokern, Calif., Naval Station, in a talk entitled *Air Conditioning for Environmental Test Chamber*. • • • An informative presentation on noise problems in modern air distribution systems was given at a BALTIMORE Chapter meeting by W. L. Batchelor, chief engineer, Tuttle & Bailey, division of Allied Thermal Corp., New Britain, Conn. A lively question and answer period followed this talk, entitled *Modern Trends in Air Distribution*. • • • Several out-of-town guests attended a meeting of the BRITISH COLUMBIA Chapter at which C. S. Stock, manager, unit ventilator department, American Air Filter Co., Inc., Louisville, Ky., spoke on the *Laboratory School — A Scientific Evaluation of Comfort Conditions and Building Performance*. Mr. Stock described in detail a series of tests conducted at a school in Auburn, Me., while school was in session. He pointed out that even though the tests were run on classrooms with northern exposure and with only clerestory windows facing south, cooling rather than heating proved to be the major problem. • • • A thorough review of equipment needed for *High Temperature Hot Water Heating Systems* was presented at a CENTRAL NEW YORK Chapter meeting. The speaker, J. H. Hanley, manager of industrial sales, Bell & Gossett Co., New York, N.Y., confined his discussion to current American practice, including what he considered to be the principles and hazards of design. He clarified many of the points in his discussion by referring to specific examples, such as recent installations made at Idlewild Airport and at Army and Air Force bases. • • • The guest speaker at an INLAND EMPIRE Chapter meeting was Harry Todd, Orr & Sembower, Inc., Reading, Pa. He devoted his talk to the efficiencies of gas burners. He also touched on some of the problems encountered in new installations and in conversion jobs. The presentation was well received by the members and their guests. • • • The featured topic at an IOWA Chapter meeting was *Control Problems in High Velocity Double Duct Air Distribution Systems*. The speaker, H. H. Korff, mechanical engineer, Johnson Service Co., Chicago, first made mention of the differences between medium and high pressure systems in relation to velocity and static pressure. He particularly described the high velocity double-duct system, noting the method of operation, and the advantages and disadvantages of such a system • • • Kenneth Chamberlain, plastic consultant, Industrial Plastic Fabricators, Inc., Norwood, Mass., before a MASSACHUSETTS Chapter audience, related the *History and Uses of Polyvinyl Chloride Material for Corrosion Problems*. The provocative talk acquainted the members with what has been and is being done with plasticized polyvinyl chloride in fabrication of piping, valves, fittings, fans and numerous other products presently needed in the chemical industries and other associated businesses. • • • Vice Pres. Fred Vogt, MINNESOTA Chapter, introduced the speaker of the evening, L. F. Flagg, supervisor of commercial field training, Minneapolis-Honeywell Regulator Co., who devoted his time to *Air Blending Systems.* • • • The complex behavior of the human body in adjusting to variations in temperature and humidity was outlined for the MONTREAL Chapter members in a program entitled *Comfort Conundrum.* This talk was presented in an exceedingly interesting fashion by Prof. W. Bruce, mechanical engineering department, McGill University, Montreal, Que. • • • *An Evaluation of Air Cleaning Equipment* was made at a previous Montreal Chapter meeting by G. F. Landgraf, vice president, engineering, Trion, Inc., McKees Rocks, Pa. Mr. Landgraf considered various aspects of filtering, with particular emphasis on the application of electro-precipitation. Each of 8 members of a panel also delivered a short talk on miscellaneous aspects of the subject. • • • The fundamental principles of sound and the elimination of noise transmission in ducts comprised the subject for another Montreal Chapter program. Walter Elliott discussed *Noise Problems in Ventilating and Air Conditioning,* explaining in simple terms. • • • On the rostrum at a NEBRASKA Chapter meeting, Keith Newhouse, professor, University of Nebraska, explained the operation of the steam jet air-conditioning system at the University and presented figures on the efficiencies. In his thoroughly enjoyable address, he also discussed plans for future installations. • • • NEW MEXICO Chapter heard Bert Dahm, Roy E. Roth Co., Rock Island, Ill., in an interesting talk on the development, use and benefits of the turbine pump. • • • A NEW YORK Chapter audience heard M. M. Harris, Harrison and Abramovitz, New York, N. Y., discuss the *Effects of Air Conditioning on Present Buildings.* Mr. Harris illustrated various types of design and noted the problems involved in providing the space needed for air conditioning in modern types of buildings. He showed the difficulties encountered in keeping air-conditioning equipment entirely out of sight, and stated that it is possible to leave the equipment exposed when it fits into an architectural treatment. The speaker stressed the need for cooperation between the architect and the engineer in solving problems. Following the presentation, Mr. Harris replied to questions from the floor for a considerable period of time. • • • Food refrigeration was the topic of a NORTH JERSEY Chapter presentation by D. C. McCoy, construction engineer. • • • H. R. Bohannon, chief engineer, Acme Equipment Co., Muskogee, Okla., spoke at a NORTHEASTERN OKLAHOMA Chapter meeting. Mr. Bohannon described the methods of air measurement as required by various associations. He covered such aspects as test apparatus, the number of readings required, fan system curves and fan laws. • • • On one occasion, NORTHERN ALBERTA Chapter had as its guest speaker C. S. Stock, manager, unit ventilator department, American Air Filter Co., Inc., Louisville, Ky. He gave his informative talk on the *Laboratory School — A Scientific Evaluation of Comfort Conditions and Building Performance.* With the aid of colored slides, he showed the many interesting tests and experiments carried out at the Washburn Experimental School in Maine. • • • A previous program presented by the Northern Alberta Chapter featured an address by P. Bouthillier, associate professor of civil engineering, University of Alberta. His subject was *Centrifugal and Turbine Pumps — The Whys and Wherefores of Their Operation, Installation and Maintenance.* Professor Bouthillier showed a film, demonstrating the important maintenance and installation points for centrifugal and turbine pumps. The speaker also outlined the basic differences between the two types of pumps, and noted the necessity for accurately calculating head and quantity requirements in order to make a proper selection. • • • *Steam Trapping and Air Venting* was the topic which was capably handled by J. M. Thompson, guest speaker at a NORTHERN PIEDMONT Chapter meeting. Four basic types of traps—thermostatic, mechanical, orifice and thermodynamic—were described, and each type was discussed in detail as to its operating characteristics and application. • • • An excellent program was conducted by J. H. Colby, vice president and general sales manager, Johnson Service Co., Milwaukee, Wis., at an OKLAHOMA Chapter meeting. In a talk on *Air Velocity Controls Applied to Heating and Air-Conditioning Systems,* Mr. Colby discussed the application of controls to the supply return and exhaust systems in low and high pressure duct design. At his disposal was a model display of actual working controls and dampers in ducts. • • • *The St. Lawrence Power Project* was the subject of an ONTARIO Chapter speaker, T. G. Willows, special assistant to the chief engineer, Ontario Hydro Commission. Mr. Willows address was accompanied by slides of the St. Lawrence project. A lengthy discussion period followed this presentation which was given at a joint meeting with the WESTERN NEW YORK Chapter. • • • An ASHAE member, H. W. McKenzie, owner, H. W. McKenzie Co., Portland, Ore., spoke at an OREGON Chapter meeting. The essence of the talk was the design and installation of air conditioning on the recently converted luxury liners Mariposa and Monterey. Supplementary slides showed the progress of external conversion, general ship layout, equipment installations and views of completed interiors. Mr. McKenzie gave a good technical report, dealing with the rigid design specifications, unusual equipment installations, tight shipboard space limitations and various features not normally encountered on load structures. • • • An enlightening talk on sound was given by Dr. Elliott of Sheldons Ltd. at a meeting of the OTTAWA VALLEY Chapter. Sound frequencies were demonstrated by a recording. • • • Fourteen students from the University of Washington

GUIDE ADVISORY COMMITTEE MEETS

Meeting at Society Headquarters, April 3, 1957, members of the Committee continued their consideration of problems arising in connection with planned new arrangements for publication of THE GUIDE *(l. to r.)*: J. H. Ross, Toronto, Canada; P. B. Gordon, New York, N.Y.; J. C. Fitts, New York, N.Y.; R. E. Cherne, Rochester, N.Y.; C. E. Price, Chicago, Ill.; and A. Giannini, New York, N.Y.

and Seattle University were present at a PACIFIC NORTHWEST Chapter meeting. Largely for the benefit of the students present, S. D. Peterson, branch manager, Johnson Service Co., Seattle, Wash., told about *The Young Engineer in the Field of Heating and Air Conditioning.* After giving the students some sound advice, Mr. Peterson, a past president of the chapter, described the phenomenal growth of the building industry and the many opportunities in this business for young engineers. • • • A PHILADELPHIA Chapter audience enjoyed a program on *High Temperature Hot Water Heating Systems.* The speaker of the evening was S. F. Mumford, High Temperature Hot Water Division, Combustion Engineering, Inc., New York, N.Y. • • • The presentation on *Characteristics of Forced Hot Water Heating Systems* by Frank Gall, manager, heat transfer department, Bell & Gossett Co., Morton Grove, Ill., was delivered at a PITTSBURGH Chapter meeting. • • • A provocative talk on refrigeration piping was presented before the SACRAMENTO VALLEY Chapter by Henry Guilmette, Pacific Scientific Co., San Francisco. The chapter also heard a brief talk by R. J. McKinnon, sales engineer, Minneapolis-Honeywell Regulator Co., Sacramento, Calif., on 3-way valves. • • • Two speakers addressed a SOUTH CAROLINA Chapter gathering. Julian Lemond, representative from Charleston County to the State Legislature, discussed the problem of air pollution in South Carolina and in Charleston County in particular. Mr. Lemond compared the air pollution problem in South Carolina with that of Southern California, with which he is familiar. The second speaker, D. C. Galloway, smoke abatement officer, City of Columbia, S.C., traced the history of man's efforts to cope with the pollution of the atmosphere caused by the burning of fuel and also by industrial waste. He gave several examples of the efforts of various cities to remedy these conditions. • • • An interesting treatise on the threshold of sound was given at a SOUTH TEXAS Chapter meeting by Bruce Ellis, chief engineer, Buffalo Forge Co., in a talk entitled *Noise in Centrifugal Pumping Systems.* Mr. Ellis referred to the relationship between decibel ratings and noise frequency, and to the relationship between the drive and impeller in regard to the frequency curve. • • • A 3-part program was presented at a SOUTHERN CALIFORNIA Chapter meeting. K. G. Blessing, district representative, Worthington Corp., Los Angeles, spoke on *Compressors. Air Cooled Condensers vs. Cooling Towers Evaporative Condensers* was treated by O. M. Butler, district sales manager, Bush Manufacturing Co., Riverside, Calif. The third speaker, Maron Kennedy, sales engineer, York Corp., Los Angeles, Calif., covered the subject of *Refrigerants.* • • • In a talk on *Combustion* given at a SOUTHERN PIEDMONT Chapter meeting, William Gardner, Cyclotherm Division, National-U. S. Radiator Corp., Johnstown, Pa., specially mentioned combustion as related to packaged steam or hot water generating units. Following the well-received talk, Mr. Gardner demonstrated a model unit. • • • At a SOUTHWEST TEXAS Chapter meeting, G. R. Rhine, owner and manager, George Rhine & Co., San Antonio, Tex., was the guest speaker. He covered a wide range of subjects: the history of fire, types of heaters and heat exchangers, and various heating systems. • • • The structure of the Ohio State Board of Building Standards was described at a meeting of the TOLEDO Chapter. J. R. Ahart, consulting engineer, Dayton, Ohio, made the presentation. Minimum standards for schools were discussed in some detail. The great number of questions at the conclusion of the talk indicated considerable interest. • • • H. E. Smith, vice president, Schultz & James, Inc., Richmond, Va., delivered an informative talk on *Package Steam Generators* at a VIRGINIA Chapter meeting. • • • *Chemical Dehumidification* was the topic covered by D. M. Valentine, district manager, Kathabar Division, Surface Combustion Corp., Park Ridge, Ill., at a meeting of the WESTERN MICHIGAN Chapter. Mr. Valentine noted 3 principal ways to remove moisture from air: condensation on cold surface, adsorption process and absorption process. He then gave a number of specific instances of industrial applications of these processes, and discussed the equipment available for this purpose. • • • *Lay That Slide Rule Down* advised P. J. Grogan, director of engineering institutes, University of Wisconsin, Madison, Wisc. Mr. Grogan, speaking before the WISCONSIN Chapter, demonstrated many shortcut methods for doing simple mathematical problems mentally. He suggested an alternative title for his subject, *Gears between the Ears.* Students from the University of Wisconsin Engineering School were guests at the meeting. • • • Members and guests of the PURDUE UNIVERSITY Student Branch heard Jack Clarke, vice president, Van Ausdall and Farrar Co., in an informative talk on the need for good communications within 1 industry.

Tours

Excellent representation was indicated when a group of 50 members and guests of the EMPIRE STATE CAPITAL Chapter visited the new Behr-Manning Company office building on a conducted tour. Special attention was given to the air-conditioning system and some of the manufacturing facilities. Everyone had an opportunity to visit the high temperature hot water boiler plant. • • • The WESTERN NEW YORK Chapter traveled to Toronto for a joint meeting with the ONTARIO Chapter. The two chapters enjoyed a field trip to the A. W. Manby Service Center of the Ontario Hydro Commission. Here the members and guests saw working models of the various parts of the St. Lawrence seaway project.

Panel Presentations

Interest in a panel discussion presented at an ARIZONA Chapter meeting was greatly apparent. Those who took part were Bart Albright and Vic Palmer, for the engineers; V. J. Carns and E. P. Hennesy, for the suppliers; and J. L. Taylor and J. M. Huff, for the contractors. James Donohue, president, Climate Control Co., Phoenix, Ariz., acted as moderator. Written questions from the audience were answered by the panel after a 10-minute discussion by 1 member of each group on the relation of his group to the user of air-conditioning equipment. • • • Various phases of the problems of jobbers in the heating and air-conditioning industry were covered at an ATLANTA Chapter meeting. Al Long, Noland Co., introduced the other members of the panel: Robert Holman, Cowan Supply Co., and M. E. Ferrell, Jr., Crane Co., Atlanta, Ga. The members, who posed several questions for the panelists after the formal presentation was completed, found the subject matter timely and well presented. • • • NORTHERN ALBERTA Chapter held a panel discussion on *Relations in the Construction Industry between Architect, Engineer, Supplier, and Subcontractor.* Emphasis was placed on the effect these relationships have on the mechanical subtrades. E. K. Cumming acted as chairman of the discussion. Representing the architects' point

D

Dehumidification Bulletin Ready

The bulletin contains the 5 papers presented at the Symposium on DEHUMIDIFICATION (with digest of discussions) at the Chicago Meeting on February 26, 1957. Please mail ...... copies at $1.00 each, postpaid.

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Journal Section

of view was E. G. Forbes, while P. M. Butler spoke for the engineers. Harry Hole represented the mechanical contractors, and D. A. Peckinpaugh supported the suppliers. The many views presented included a plea for more cooperation, the desirability of engineering contractors, the importance of the independent approach of the architect and engineer, and the conclusion that the present relations and method of operation in the construction industry, while needing some improvements, are still the best approach to the problem of providing the best buildings.

J. S. Locke
Reports to Minnesota Chapter

Non-technical Programs

The *Picture of the Engineering Shortage and Situation* in the colleges of America was presented in a brief talk at an AUSTIN Chapter meeting by William Amstead, University of Texas. Mr. Amstead explained that this shortage is due to increased industrial economy, increased complexity of products requiring more engineering skills, and the national security situation, with accompanying heavy requirements placed on the engineering profession. • • • The subject of taxes was on the agenda at another AUSTIN Chapter meeting. Lynn Anderson, University of Texas Institute of Public Affairs, noted that the taxes levied on any businessman today are a larger item in his business and personal cost than at any time in the past. A spirited discussion followed his remarks. • • • At a joint *ASRE*-ASHAE meeting of the DELTA Chapter, James D. McGovern spoke on *Specification and Contract Documents.* • • • Following an enthusiastic report by Pres. J. B. Rishell on the Chapters Regional Committee meeting held in Detroit, Bernard Silverstein showed the members of the MIAMI VALLEY Chapter a series of slides taken on his recent trip to Spain and Portugal. • • • At a MINNESOTA Chapter meeting a discussion of ways to advance the heating and air-conditioning profession was held. Members suggested that young men be encouraged to go into the air-conditioning field. The possibility of having members of the chapter give lectures to civic groups was mentioned. • • • The Curling Bonspiel, an outstanding social event of the MONTREAL Chapter, was held in early spring. Invitations were issued to the chapters at TORONTO and QUEBEC.

Elections and Appointments

ARKANSAS Chapter's tellers committee consisted of K. A. Pettit, as chairman, with G. M. Cook and J. H. Lammons as members. Mr. Pettit announced the newly-elected officers: *President*—H. H. Himstedt; *Vice President*—K. A. Pettit; *Secretary*—Allen Bullard; *Treasurer*—O. L. McCallister, Jr.; *Board of Governors*—T. W. Turner and Fred Tenny. The outgoing president, J. W. Thompson, appointed G. M. Rozzell, Jr., as a member of the code committee to replace J. S. Binder. The other members of this committee are R. E. Blaylock and J. L. Brown. • • • S. L. North reported for the ATLANTA Chapter tellers committee, stating that ballots cast indicated the election of the following officers for 1957-58: *President*—J. A. Marshall; *Vice President*—J. E. Edgar; *Secretary*—W. P. West; *Treasurer*—E. W. Klein, Jr.; *Board of Governors*—T. A. Barrow, Jr., and F. W. Bull. • • • Elected to a nominating committee for the AUSTIN Chapter were R. E. Reese, G. M. Warren, R. J. Barnhart, J. M. Boyer and F. W. Gerling. Pres. B. E. Segall, Jr., appointed T. M. Stephens as general chairman of the June picnic. • • • Pres. W. G. Robertson, Jr., BALTIMORE Chapter, appointed an auditing committee, consisting of C. J. Peters, D. A. Lamb and Milton Snyder, to examine the 1956-57 records. • • • The new slate of officers for the CENTRAL NEW YORK Chapter for 1957-58 was elected as follows: *President*—Merle Weninger; *Vice President*—E. L. Moyer; *Secretary*—S. F. Gilman; *Treasurer*—E. F. Smarzo; *Board of Governors*—R. A. Barr and J. W. Stevens. • • • A tellers committee, comprised of W. J. Donovan, chairman, A. L. Otis and E. J. McArdle, reported on the annual election of the CONNECTICUT Chapter. This slate of officers was unanimously elected: *President*—Fritz Honerkamp; *Vice President*—J. D. Pierce; *Secretary*—F. J. Raible, Jr.; *Treasurer*—R. B. Cahoon; *Board of Governors*—Walter Heywood, E. M. Johnson and Eric Olsson. The retiring president, Walter Heywood, spoke briefly before turning the gavel over to the new president. • • • Pres. R. M. Spencer, at the April meeting of the KANSAS CITY Chapter, expressed his appreciation to all the committee chairmen and to everyone who had served in any capacity during his year in office. A voice vote indicated that the following slate of officers was elected: *President*—S. C. McCann; *Vice President*—J. E. Miller; *Secretary*—J. C. Fasnacht; and *Treasurer*—L. A. Heaven. On April 23, due to the sudden death of vice president-elect Jesse E. Miller, a special meeting of the 1956-57 board of governors was held, at which a revised list of officers was submitted by the nominating committee. • • • MANITOBA Chapter's new slate of officers for 1957-58 will be: *President*—R. M. Fraser; *Vice President*—D. S. Swain; *Secretary*—J. J. MacKenzie; *Treasurer*—K. J. McCartney; *Board of Governors*—G. T. Christie, A. K. Piercy, N. B. Jorgensen, Stanley Hayden, W. D. Fraser, and A. H. Millar. • • • Pres. W. G. Martin, Jr., MASSACHUSETTS Chapter, appointed H. F. White and W. R. Blair as a ballot committee to tally the results of the annual election of officers. The committee reported the election results: *President*—E. L. Blair; *Vice President*—R. F. Curry; *Secretary*—R. E. Reid; *Treasurer*—F. J. Butler; *Board of Governors* (3-year term)—C. A. Biancucci, W. R. Geissenhainer and L. V. Richards; *Board of Governors* (1-year term)—C. T. Mather. • • • Looking ahead, J. S. Locke, MINNESOTA Chapter, reported on plans for the 1958 Semi-Annual Meeting of the Society. Committee chairmen were announced as follows: *Vice Chairman*—G. M. Kendrick; *Honorary Chairman*—F. B. Rowley; *Reception*—M. S. Wunderlich; *Sessions*—William Sturm; *Transportation*—Joseph Craig; *Banquet*—L. C. Gross; *Entertainment*—J. F. Siegel; *Finance*—V. E. Pearson; *Ladies*—S. L. Furber; *Children's*—R. M. Jack; *Sports*—B. F. McLouth; and *Publicity*—W. J. Ortman. Election results were announced for chapter officers: *President*—Fred Vogt; *Vice President*—J. H. Jester; *Secretary*—J. W. McNamara; *Treasurer*—R. G. Gridley; *Board of Governors*—V. E. Pearson and J. A. Craig. • • • Pres. S. R. Plamondon, in a review of the MONTREAL Chapter's activities for his year in office, expressed great satisfaction for the success of the meetings, and thanked the various committees who made this possible. R. J. Ker, chairman of the nominating committee, introduced the officers for the coming year: *President*—D. J. McIntyre; *Vice President*—A. de Breyne; *Secretary*—P. Thibault; *Treasurer*—W. U. Robinson; *Board of Governors*—B. J. Horsburgh, S. R. Plamondon, W. E. Jarvis, D. L. Lindsay and G. N. Martin. President McIntyre, in taking office, made the traditional presentation of the past president's pin and gavel to Past President Plamondon. The chairmen of the working committees were introduced by President McIntyre as follows: *Speakers*—H. B. Cooper; *Publicity*—W. H. Renwick; *Membership*—J. L. Goodenough; *Entertainment*—V. L. Savage; *Publications*—B. J. Horsburgh; *Attendance and Reception*—Frank

P. H. Yeomans
Elected Philadelphia president

Mallozzi; and *Golf and Curling*—T. E. Cockman. • • • L. J. Paulsen, president, appointed the last 3 past presidents of the NEBRASKA Chapter to the election committee. T. E. Davis was named chairman, with C. A. Goth and O. J. Smith as committeemen. • • • The chairman of the board of tellers for NEW YORK Chapter, J. P. Lyon, reported that the following had been elected: *President*—C. R. Hiers; *Vice President*—W. J. Olvany; *Treasurer*—W. M. Heebner; *Secretary*—L. D. Carr; *Board of Governors*—S. R. Apt, P. A. Bourquin, J. M. Levy, and S. A. Spencer. • • • Secy. S. H. Nitzberg, NORTH JERSEY Chapter, was instructed to cast a ballot for the new slate of officers: *President*—Martin Christesen; *Vice President*—S. H. Nitzberg; *Secretary*—L. G. Huggins; *Treasurer*—C. E. Parmelee; *Board of Governors*—C. W. Zimmer, H. P. Morehouse, R. S. Taylor, and W. C. Kruse, Jr. • • • W. C. Roads, R. W. Winget and Fred Colbert were appointed as nominating committee for the NORTHEASTERN OKLAHOMA Chapter. • • • The OKLAHOMA Chapter president, F. R. Denham, appointed a ballot committee, consisting of W. V. Leftwich, chairman, G. B. Hughes and C. O. Jensen. The committee found the following to be elected for the coming year: *President*—A. C. Shelley; *Vice President*—W. R. Johnson; *Secretary*—W. H. Stewart; *Treasurer*—T. L. Robinson; *Board of Governors*—E. F. Dawson and J. R. Patten. President Denham also appointed an auditing committee, with L. E. Wickline as chairman, and L. L. Von Tungeln and Paul Sprehe as members. • • • The 1957 committee chairmen for the OREGON Chapter were announced by Pres. W. B. Hayes: *Meetings*—Keith Kruchek; *Membership*—E. S. Constant; *Attendance*—C. F. Ingham; *Public Relations*—C. W. Timmer; *Finance*—W. R. Norte; *Legislative*—Dick Blankenship; *Social*—F. T. Taylor; *Student Assistance*—W. C. Phillips; *Research*—T. H. McClung; *Diffuser Editor*—J. L. Waymire; and *Circulation Manager*—J. P. Schenck. • • • The following slate of officers will serve the PHILADELPHIA Chapter for the year 1957-58: *President*—P. H. Yeomans; *1st Vice President*—C. J. Forve; *2nd Vice President*—J. J. Hucker; *Treasurer*—Ludwig Mack; *Secretary*—D. S. Plewes; and *Board of Governors*—John Everetts, Jr. • • • Pres. V. W. Thornburg, SACRAMENTO VALLEY Chapter, announced the appointments for the nominating committee. John Day will serve as chairman, with R. L. Basye, L. S. Stecher, F. H. Taylor, and A. J. Routhier, as members. • • • SOUTHERN CALIFORNIA Chapter elected J. C. Hall, Jack Miller, C. D. Walz, W. O. Stewart and V. A. Megna to its nominating committee.

Personals

At a meeting of the EMPIRE STATE CAPITAL Chapter, G. A. Teeling was introduced by Pres. G. G. Davis. Mr. Teeling has been a member of the Society for over 25 years. • • • E. M. Hopkins, attendance chairman, KANSAS CITY Chapter, presented awards to D. E. Brewer, and A. L. Roberts, Jr. • • • The president of MANITOBA Chapter, A. H. Millar, presented a past president's pin to G. C. Davis. • • • Pres. S. R. Plamondon, MONTREAL Chapter, bid farewell to Robert Clapperton, chairman, membership committee, who will leave shortly to take up residence in California. President Plamondon thanked Mr. Clapperton for his long service to the chapter in many capacities. • • • A life membership certificate was presented at a NEW YORK Chapter meeting to P. H. Schoepflin by Pres. J. B. Hewett. • • • ONTARIO Chapter's award winner at the University of Toronto, G. A. Nuttall, was introduced to the chapter by Pres. C. J. Bootes. • • • Pres. W. B. Hayes, OREGON Chapter, presented a set of bookends to W. R. Norte, expressing the appreciation of all the chapter members for Mr. Norte's leadership during the past year. • • • Presentation of the Gustas L. Larson Award for 1957-58 was made at a WISCONSIN Chapter meeting by Dean Wendt to R. L. Neuman.

G. C. Davis

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 160 men who are candidates for membership, or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before June 30, 1957, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: †*Reinstatement* **Advancement*

Arizona (*Region* 4)

Palmer, S. R., Head, Drafting Room, John Paul Jones, Tucson.

Arkansas (*Region* 6)

Thompson, J. W.*, Gen. Mgr., Fagan Air Conditioning Co., Inc., Little Rock.

Tsakir, George, Dist. Mgr., Minneapolis-Honeywell Regulator Co., Little Rock.

California (*Region* 4)

Bogen, J. A., Sales Engr., American Air Filter Co., Inc., Los Angeles.

Burke, J. W., Owner, Burke Engineering Co., Los Angeles.

Burkhardt, W. L., Owner, Power Boiler Sales, San Francisco.

Houghton, J. W., Sales Engr., Westinghouse Electric Corp., A-C. Div., Los Angeles.

Jones, J. C., Sales Engr., West Sacramento Sheet Metal, Sacramento.

Jonynas, A. V., Engr., Pereira & Luckman, Los Angeles.

Lacey, A. H., Sales Engr., Westinghouse Electric Corp., Los Angeles.

Lowe, M. G., Chief Mech. Engr., Quinton Engineers, Ltd., Los Angeles.

Martin, D. W., Sales Engr., General Electric Co., San Francisco.

McLendon, H. B., Sales Mgr., The Mettler Co., Inc., Los Angeles.

Moore, T. E., Br. Sales Engr., The Coleman Co., Inc., Los Angeles.

Morgan, E. R., Mgr., Industrial Plumbing Corp., Sacramento.

Nero, W. E., Sales Engr., American Air Filter Co., Inc., San Francisco.

Ramsey-Raisan, D. M. C., Administrative Engr., Dudley Deane and Associates, Mill Valley.

Reynolds, J. A.†, Sales Engr., Minneapolis-Honeywell Regulator Co., Los Angeles.

Schmoker, R. F., Br. Mgr., American Blower Corp., Sacramento.

Wightman, G. W., Mech. Design Engr., J. Marx Ayers, Cons. Mech. Engr., Los Angeles.

Colorado (*Region* 3)

Medley, J. C., Div. Mgr., The Mitchell Co., Fort Collins.

Connecticut (*Region* 1)

Bedula, Stephen, Jr. Engr., Paul D. Bemis, Cons. Engrs., Hartford.

District of Columbia (*Region* 5)

Bergheim, J. H., Tech. Secy., *Air-Conditioning and Refrigeration Institute,* Washington.

Florida (*Region* 5)

Burnes, R. L., Repr., Barber-Colman Co., Jacksonville.

Duffek, A. F., Mech. Designer, Reynolds, Smith & Hills, Jacksonville.

Irons, R. E., Engr., Smith & Gillespie, Jacksonville.

Israel, G. A., Jr., Owner, George A. Israel, Jr., Co., Jacksonville.

Johnson, G. B., Sales Engr., Johnson Service Co., Jacksonville.

Kirkpatrick, J. C., Pres., Southside Fuel Oil Co., Inc., Jacksonville.

Leggett, J. T., Br. Mgr., R. J. Clark Equipment Co., Inc., Jacksonville.

Morton, R. H., Engr., Paul Hardeman, Inc., Jacksonville.

Parlette, L. R., Engr., Reynolds, Smith & Hills, Jacksonville.

Stewart, P. E., Vice Pres., Refrigeration Supply Co., Jacksonville.

Stinson, J. A., Sales Engr., R. J. Clark Equipment Co., Inc., Jacksonville.

Vollers, C. T., Jr., Mgr., Htg. Dept., E. G. Golder Co., Inc., Jacksonville.

White, H. W., Sales Repr., Minneapolis-Honeywell Regulator Co., Jacksonville.

Wilhelm, H. A., Sales Engr., Southside Fuel Oil Co., Jacksonville.

Winsryg, M. A., Instructor, Technical High School, Jacksonville.

Georgia (*Region* 5)

Durkin, F. M., Sales Engr., Mingledorff's Inc., Savannah.

Hubbs, S. L., Repr., Jenkins Bros., Atlanta.

Illinois (*Region* 2)

Acierno, T. G.*, Engr., Corn Products Refining Co., Chicago.

Anderson, R. M., Sales Engr., Air Comfort Corp., Chicago.

Biddle, K. F., Plant Engr., Sundstrand Aviation, Rockford.

Hull, R. L., Chief Engr., DeBothezat Fans Div., American Machine & Metals, Inc., East Moline.

Journal Section

Loots, W. G., Appl. Engr., Carrier Corporation, Chicago.

Merel, J. B., Partner, United Sheet Metal Works, Chicago.

Merel, W. E., Partner, United Sheet Metal Works, Chicago.

Meyers, John, Mech. Engr., R. G. Burkhardt & Assoc., Chicago.

Morita, W. I.*, Proj. Engr., Shaw, Metz & Dolio, Chicago.

Moses, J. E., Chief Estimator, United Sheet Metal Works, Chicago.

O'Loughlin, F. P., Mech. Designer, Pioneer Service and Engineering Co., Chicago.

Indiana (*Region* 2)

Boyd, R. E., Mgr. Retail Div., Hall-Neal Furnace Co., Indianapolis.

Iowa (*Region* 3)

Gadbury, D. F., Gen. Mgr., Gadbury Plumbing & Heating, Fort Dodge.

Kansas (*Region* 3)

Fasnacht, J. C.*, Assoc. Engr., Robert R. Bayles & Assocs., Mission.

Haughinberry, C. W., Jr., Estimator, Jess Miller Sheet Metal Co., Mission.

Hoss, D. C., Owner, Hoss & Assocs., Topeka.

Kentucky (*Region* 5)

Graf, C. J., Partner, Southern Engineering Co., Louisville.

Hannan, E. T., Engr., E. D. Hannan Co., Paducah.

Maine (*Region* 1)

Lunt, W. F.*, Owner, Lunt Heating Co., Cape Elizabeth.

Maryland (*Region* 5)

Clare, J. T., Designer, Henry Adams Co., Baltimore.

Massachusetts (*Region* 1)

Raymon, Mark, Partner, Hastings Air Control, Brookline.

Snow, J. F., Fan Engr., Davidson Fan Co., Newton.

Michigan (*Region* 2)

Kroll, H. J., Sales Engr., York Corp., Detroit.

Luty, D. J.†, President, Luty Furnace Manufacturing Co., Detroit.

Minnesota (*Region* 3)

Dovolis, J. J., Mgr.-Owner, D. C. Sales Co., Minneapolis.

Hedsten, G. C.†, Engr., Comfortrol Supply Co., Rochester.

Missouri (*Region* 3)

Anderson, D. R., Pres. & Mgr., Anderson Heating & Air Conditioning Co., Sedalia.

Cowan, J. H., Jr., Repr., D. M. Allen Co., Kansas City.

Daegele, Roy, Sales Engr., The Powers Regulator Co., St. Louis.

Drummond, W. K., Mech. Engr., Natkin & Co., Kansas City.

Dworkin, Archie, Sales Engr., S. C. McCann Co., Kansas City.

Elliott, L. H., Jr., Engr., Belt & Given, St. Louis.

Fisher, F. E., Owner, Floyd E. Fisher, Kansas City.

Garnett, S. P., Engr., American Radiator & Standard Sanitary Corp., Kansas City.

London, R. J., Repr., National-U. S. Radiator Corp., St. Louis.

Reed, F. B., Sales Mgr., The Marley Co., Kansas City.

Rosebrough, J. D.†, Repr., American Blower Co., Kirkwood.

Weddle, R. D., Engr., Natkin & Co., Kansas City.

Montana (*Region* 3)

Berry, R. W., Mech. Design Engr., Drapes Engineering, Great Falls.

Heinecke, W. C. E., Partner, Brinkman & Lenon, Kalispell.

Nebraska (*Region* 3)

Ryan, J. E., Mgr., Htg. Dept., Crane Co., Omaha.

New Jersey (*Region* 1)

Hubbard, R. D., Asst. Mgr., A-C. & Unit Heater Sales, Warren Webster & Co., Camden.

Zisman, Jules, Sales Engr., The Conditioning Co., Inc., Newark.

New York (*Region* 1)

Blank, M. J., Sales Engr., G. W. Westenhofer, Valhalla.

Bumpus, H. A. C., Jr., Engr., Rochester Research Corp., Rochester.

Carnabuci, F. J., Pres., Border Plumbing & Heating Supply Co., Port Chester.

Dubin, Melvin, Pres., Slant-Fin Radiator Corp., Richmond Hill.

D'Angelo, C. A., Sales Engr., Grinnell Corp., Buffalo.

Koenig, Seymour*, Sales Engr., Minneapolis-Honeywell Regulator Co., Long Island City.

Levine, Henry, Pres., Aireco Inc., Schenectady.

Maguire, B. S., Engr., Niagara Blower Co., New York.

Newton, G. P., Mech. Engr., Sargent, Webster, Crenshaw & Folley, Syracuse.

Van Patton, H. E., Owner, John L. Rausch & Co., Wayland.

Zuckerman, R. S., Engr., The Korfund Co., Inc., Long Island City.

North Carolina (*Region* 5)

Coddington, W. I., Pres., Gas Heat Distributors Inc., Charlotte.

Slattery, J. G., Sales Engr., The Powers Regulator Co., Charlotte.

Ohio (*Region* 2)

Brewer, W. M., Vice Pres., Refrigeration Sales Corp., Cleveland.

Gabriel, J. S., Dist. Engr., Carrier Corporation, Cincinnati.

Heppert, M. H., Engr., General Electric Co., East Cleveland.

Hubert, T. F., Repr., The Trane Co., Cincinnati.

McHugh, J. N., Design Engr., A. M. Kinney Inc., Cincinnati.

Simpson, A. E., Engrg. & Estimating, E. R. Strong & Co., Cincinnati.

Stewart, W. A., Jr., Repr., National-U.S. Radiator Co., Cincinnati.

Teagle, W. C., Engr. & Partner, Shaw, Lenz & Assoc., Cincinnati.

Yount, R. F., Mgr., The Philip Carey Manufacturing Co., Dayton.

Oklahoma (*Region* 6)

Scott, Herman, Distr. Mgr., Federal Corp., Tulsa.

Oregon (*Region* 4)

Garon, R. E., Sales Engr., Peerless Pacific Co., Portland.

Pennsylvania (*Region* 1)

Ewald, E. J., Principal, Ewald & Miller, Philadelphia.

Lau, R. G., Jr., Repr., The Powers Regulator Co., Philadelphia.

McDowell, D. W., Dist. Repr., Air Conditioning Division of American-Standard, Pittsburgh.

Mehler, J. J., Jr., Project Engr., Dravo Corp., Pittsburgh.

Pickel, H. L., Sales Engr., Benjamin Foster Co., Philadelphia.

Russell, L. G., Chief Engr., W. J. Keist & Son, Inc., Pittsburgh.

Yung, R. H., Partner, Maysons Piping Contractors, Philadelphia.

Rhode Island (*Region* 1)

Zimmerman, M. W., Engr., Carl F. Brugge Co., Pawtucket.

Texas (*Region* 6)

Burden, T. W., Estimator, Burden Brothers, Inc., Dallas.

Dring, M. J., Pres., Dring Engineering Co., Dallas.

Fisher, K. M., Dist. Mgr., Penn Controls Inc., Dallas.

Hardin, D. C., Sales Engr., Johnson Service Co., Dallas.

Joiner, J. W., Pres., Joiner-Meade-Capers, Inc., Dallas.

Virginia (*Region* 5)

Putney, S. W., Jr., Owner, Putney Plumbing & Heating, Farmville.

Spencer, J. R., Head of Mech. Dept., Virginia Carolina Electrical Works, Norfolk.

Washington (*Region* 4)

Latzko, E. J., Htg. Engr., Standard Plumbing & Heating Co., Spokane.

West Virginia (*Region* 5)

Thrush, C. H., Pres., Thrush Refrigeration Co., Charleston.

Wisconsin (*Region* 2)

Adlam, G. A., Sales Engr., Heat Exchange Products Co., Milwaukee.

Bender, D. O., Chief Sales Engr., Research Products Corp., Milwaukee.

F. PAUL ANDERSON AWARD

The Committee of Award for the F. Paul Anderson Medal announces that nominations for the F. Paul Anderson Medal for 1957 are invited. Any member of the Society is eligible for nomination. The award is made in recognition of work done or service performed in the field of heating, ventilating or air conditioning.

Nominations, together with a full statement of the candidates' qualifications and achievements, should be sent to the Committee at ASHAE Headquarters, 62 Worth St., New York 13, N.Y., prior to August 1, 1957.

F. Paul Anderson Committee

E. R. Queer, *Chairman*

John Everetts, Jr. A. J. Nesbitt

John W. James F. B. Rowley

Isenring, L. L., Sales Engr., Research Products Corp., Milwaukee.

Lindsey, R. R., Sales Engr., Johnson Service Co., Appleton.

Moody, A. M. G., Chief Engr., Centrifugal Compressor Products, The Trane Co., La Crosse.

Retzinger, D. W.*, Sales Engr., Perfex Corp., Milwaukee.

Rudy, J. V., Sales Engr., Johnson Service Co., Appleton.

Stewart, R. J., Br. Mgr., Carrier Corp., Milwaukee.

Canada (*Region* 7)

Beaupre, Bernard, Tech. Repr. and Mgr., Rosemount Industries Ltd., Montreal, Que.

Coad, K. L., Sales Repr., Warden King Ltd., Winnipeg, Man.

Dorey, R. L., Sales Engr., McCarthy & Robinson Ltd., Toronto, Ont.

Fitzgerald, T. E., Vice Pres., Air-Coils Sales Ltd., Rexdale, Ont.

Husband, L. R., Dir. & Gen. Mgr., Thermotank (Canada) Ltd., Montreal, Que.

Jones, A. K., Secy.-Treas., Ernest A. Jones Ltd., Leaside, Ont.

Kruger, A. E., Mgr., Jamison & Kruger Co., Ltd., Edmonton, Alta.

Lambert, G. H., Supt., Mannix Gill, Calgary, Alta.

La Rocque, Maurice, Repr., Warden King Ltd., Quebec, Que.

Leonard, R. K., Mgr., Sales A-C Div., Fleming Pedlar, Ltd., Winnipeg, Manitoba.

Lewis, A. S., Sales Engr., Vancouver Iron Works, Vancouver, B.C.

Lynch, C. D., Reg'l. Sales Mgr., Honeywell Controls Ltd., Montreal, Que.

Miller, Arnon, Design Engr., Air Conditioning Engineering Co., Montreal, Que.

Pantel, E. H., Sr. Htg. & Vtg. Engr., Canada Chemical Co., Ltd., Edmonton, Alta.

Reid, W. H., Sales Engr., Trane Company of Canada, Toronto, Ont.

Scharf, A. D., Appl. Engr., Ainsworth Electric Co., Ltd., Toronto, Ont.

Sprigley, W. R., Repr., The Anthes-Imperial Co., Ltd., Winnipeg, Man.

Tamblyn, R. T., Mgr., A-C Div., Canadian Ice Machine Co., Ltd., Toronto, Ont.

Tirman, George, Chief Mech. Designer, Marcel A. Konforti, Cons. Engr., Toronto, Ont.

Unsworth, F. S., Plant Mgr., Hunt & Moscrop (Canada) Ltd., Quebec, Que.

Brazil

Belinky, Benjamin, Gen. Mgr., Cebec S. A., Sao Paulo.

Raigorodsky, Carlos, Mgr., Engineering Dept., Cebec S. A., Sao Paulo.

England

Byles, J. C., Sr. Partner, Cairns & Byles, Newcastle upon Tyne.

Israel

Rozen, Gideon, Project Engr., Taassan Engineering Co., Ltd., Haifa.

Italy

Borla, Ottavialberto, Tech. Dir., Aeromeccanica Italiana Borla, Turin.

Japan

Moriyasu, Toraji, Dir. A-C. Dept., Sanki Engineering Co., Ltd., Tokyo.

Union of South Africa

Ayling, K. J., Dir., Matthew Hall (Pty) Ltd., Johannesburg.

OBITUARIES

EDWARD L. BAKER
Salt Lake City, Utah

Edward L. Baker, 49, owner-manager, Edward L. Baker Co., Salt Lake City, Utah, succumbed from a cerebral hemorrhage on March 16. He had been manager of the Burbidge Coal Co., Salt Lake City, for fifteen years previous to 1952, when he began a two-year association with the Refrigeration Distributors Corp., of the same city, in charge of their heating sales and design activity.

Mr. Baker was born in Richfield, Utah, but had been a Salt Lake City resident for thirty-five years. A graduate of Granite High School, he further studied heating and combustion at the University of Utah Extension Division. In early years he served as manager of Peerless Coal Co., Jeremy Fuel Co. and Western Fuel Co., all of Salt Lake City.

In addition to Society membership, which he held since 1945, Mr. Baker held membership in the Salt Lake Executives Club. He served as secretary of the *Retail Fuel Dealers Association of Utah* for 1935. Mr. Baker was a member of the Church of Jesus Christ of Latter-day Saints.

Survivors include his widow, and three sons: Eugene, Ronald and David, all of Salt Lake City; five grandchildren, and the following sisters and brothers: Owen and Ralph Baker, Mrs. Ann Davis and Mrs. Elva Dejury, all of Salt Lake City; Evan Baker, Richland, Wash.; Mrs. Allene Wadsworth, Las Vegas, Nev.; Mrs. Ruth Livingston, Chicago.

CHARLES C. CHEYNEY
Buffalo, N.Y.

Charles C. Cheyney, 68, vice president in charge of sales, Buffalo Forge Co., died in the evening of April 25 at University Hospital, Syracuse. He had suffered a heart attack earlier in the day while on a business trip.

C. C. Cheyney

Two years ago, Mr. Cheyney was honored with Life Membership in ASHAE. He had joined the Society in 1913.

Mr. Cheyney was born in Council Bluffs, Ia. He received an M.E. from Cornell University in 1911. Upon graduation, he entered the engineering department of the Buffalo Forge Co. After a few years, he was transferred to Chicago as district engineer for the sales engineering firm, Cheyney & Emmert, who represented the company.

During World War I, he served as a lieutenant in the U. S. Navy Air Corps. He returned to Chicago as district manager and remained in that capacity until he was named assistant manager of sales and engineering in Buffalo in 1929. Progressing steadily, he became sales manager in 1945 and was elected a director four years thereafter. His selection as vice president in charge of sales came in 1953.

Long active in the standardization of codes and testing procedures for fans and blowers, he had served as president of the *National Association of Fan Manufacturers*. He was a member of the Buffalo Club and of Lorenzo Burrows Post 78, American Legion. He was also a former member of the Rotary Club and the *Sales Executives Association*.

His survivors include his wife, Evelyn Rose; three sons: Dan R., Kenilworth, Ill.; C. Houston, Glendale, Mo.; and H. Stanton, Buffalo; and a brother, Henry C., Narbert, Pa.

JESSE E. MILLER
Mission, Kans.

The Society was shocked to learn of the sudden death of Jesse E. Miller, 36, newly elected vice president of the Kansas City Chapter. He succumbed on April 12 at the Menorah Hospital, Kansas City, Mo., where he had been a patient for a week.

Mr. Miller, who was president of Jess Miller Sheet Metal, Inc., Mission, Kans., had been selected to represent the Kansas City Chapter as an alternate member of the Society's Chapters Regional Committee for Regional Area 3. Previous to his election as vice president of the chapter, he had served as treasurer and secretary. He had been active in Society affairs ever since he became a member in 1951.

At the time of his affiliation with the Society, Mr. Miller was sales manager of the A-J Manufacturing Co., Kansas City. He later became associated with Heaven Engineering Co., Kansas City, and then served successively as vice president and president of Thompson Sheet Metal Contracting Co., Inc., Mission, Kans. The company under his own name was initiated last year.

His birthplace was Dover, Mo. During World War II, Mr. Miller served with the Army Air Corps. He was a member of the Mission Optimist Club.

His survivors include his wife, Ethleen; his stepfather and mother, Mr. and Mrs. Sam Axon, Bramer, Mo.; and four brothers: Joseph, Sinking Springs, Pa.; Theodore, Independence, Mo.; Kenneth, Kansas City; and Leonard, Memphis, Tenn.

(For most recent listing of Society officers and committee personnel see Frontispiece, JOURNAL SECTION*)*

Committee on Research and Its Technical Advisory Committees

The research program of the Society is under the guidance of the Committee on Research — a General Committee — elected by the vote of Society membership. That Committee appoints Technical Advisory Committees as necessary and directs their activities. Listed below are the names of the current members of these committees.

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E. F. Snyder, Jr., Vice Chairman

One year: R. C. Chewning, W. S. Harris, N. B. Hutcheon, B. H. Jennings, P. H. Yeomans.

Two years: F. H. Faust, F. K. Hick, M.D., R. C. Jordan, H. A. Lockhart, Arthur Nutting.

Three years: D. D'Eustachio, E. S. Howarth, H. R. Limbacher, E. F. Snyder, Jr., J. I. Trimble.

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E. F. Snyder, Jr., Chairman; N. B. Hutcheon, Vice Chairman; R. C. Chewning, F. H. Faust, R. C. Jordan.

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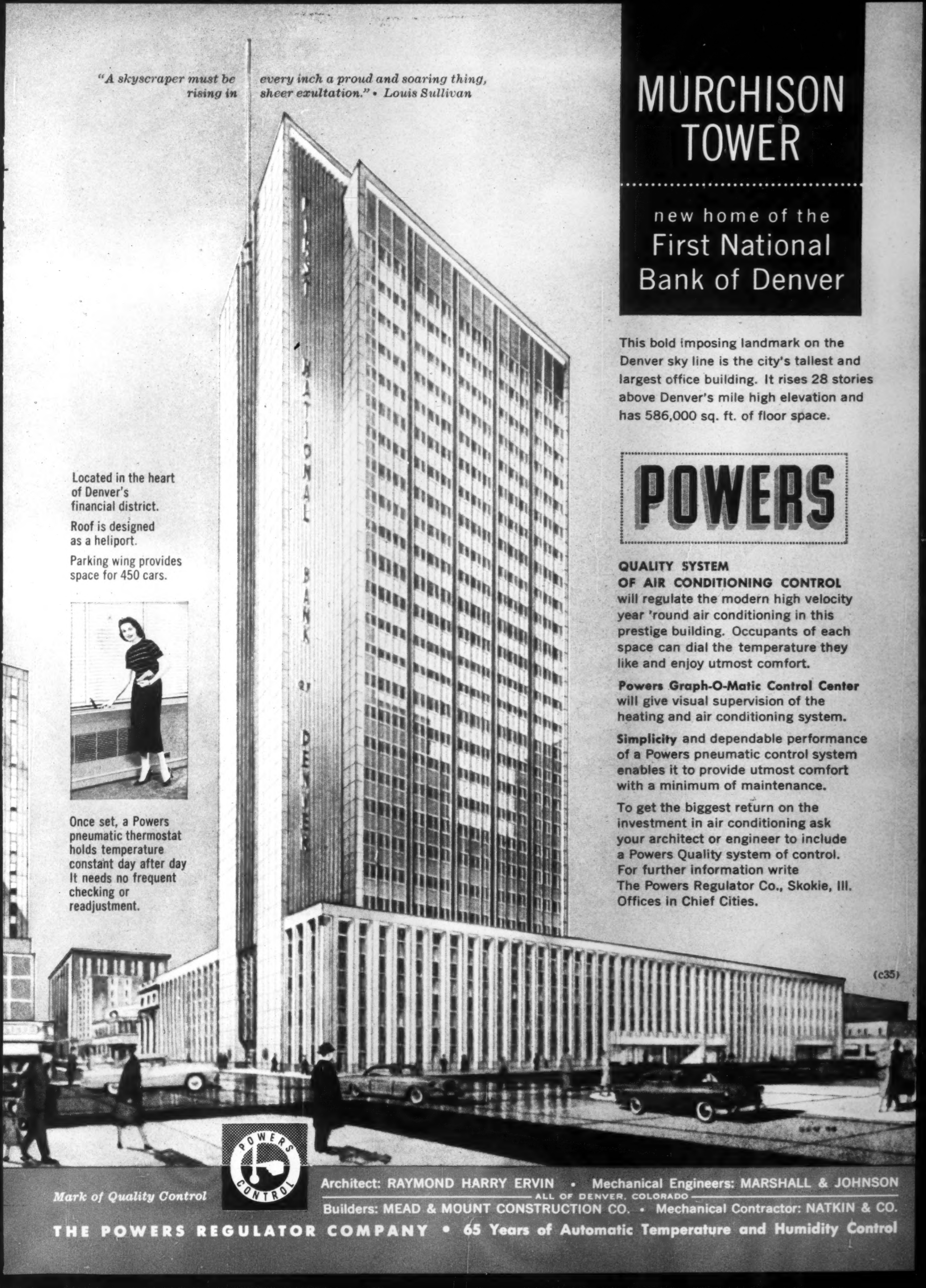
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This bold imposing landmark on the Denver sky line is the city's tallest and largest office building. It rises 28 stories above Denver's mile high elevation and has 586,000 sq. ft. of floor space.

Located in the heart of Denver's financial district.

Roof is designed as a heliport.

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QUALITY SYSTEM OF AIR CONDITIONING CONTROL will regulate the modern high velocity year 'round air conditioning in this prestige building. Occupants of each space can dial the temperature they like and enjoy utmost comfort.

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NEW MICROTEX DUCT LINER

saves cost of painting inside ducts; insures complete protection against air erosion; helps speed fabrication

Now you can get duct liner with high acoustical and thermal insulating efficiency . . . *plus* the money-saving advantages of black vinyl coating. Here's why it pays to specify L·O·F Glass Fibers' new Microtex Duct Liner:

1. No painting duct interiors—Black vinyl-coated Microtex saves the cost of painting ducts inside, near grills or large registers. Factory-pigmented coating eliminates chance of paint flaking off into airstream.

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L·O·F Glass Fibers' Microtex Duct Liner offers maximum insulation per dollar. Made from fine glass fibers, it absorbs mechanical noises, particularly in the 250 to 4,000 cps range where most heating and air-conditioning system noises occur. It efficiently insulates warm- and cold-air ducts against heat transfer. When lined with Microtex, the metal of the duct acts as a vapor barrier, minimizing condensation.

Get the facts today on economical Microtex Duct Liner in 1½, 2 and 3 lb./cu. ft. densities. Contact your distributor, or write: *L·O·F Glass Fibers Company, Dept. 39-67, 1810 Madison Ave., Toledo 1, Ohio.*

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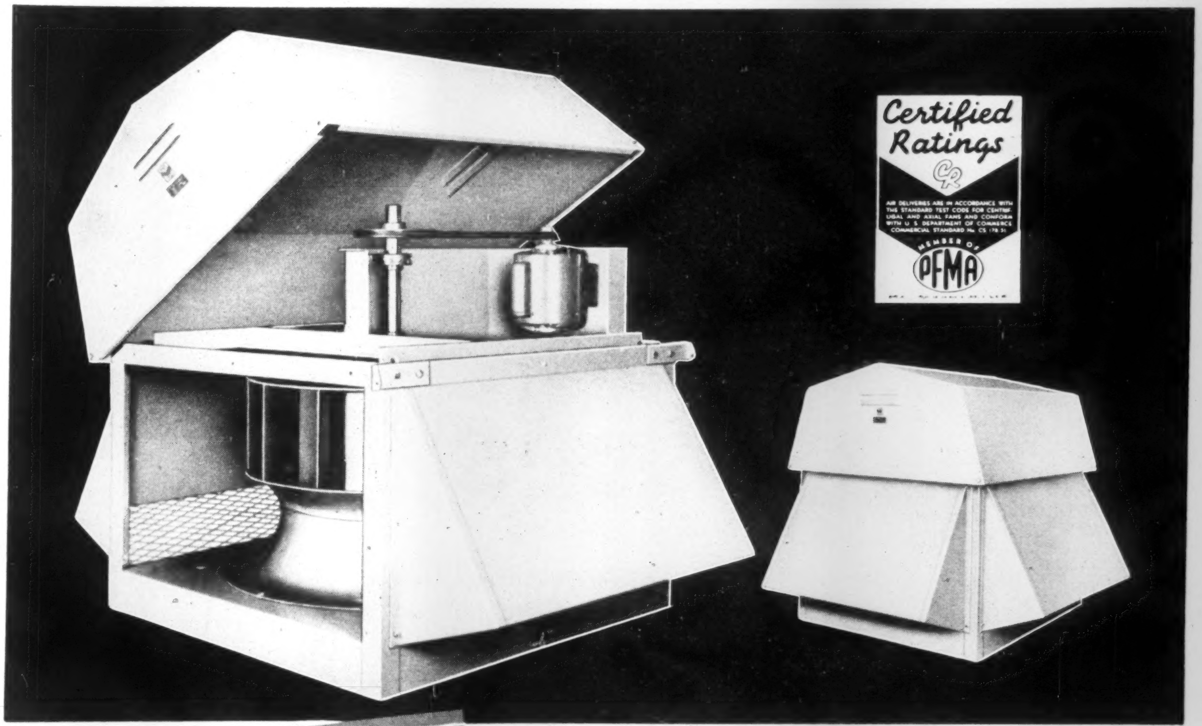

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QUIET! . . . Matching wheel cone accurately fits venturi inlet to create quieter, smoother air movement. Excellent for churches, auditoriums, hospitals, and schools.

ADAPTABILITY! . . . Fits standard curb sizes. Lower horsepower ratings for quieter operation. Higher horsepower for commercial and industrial applications.

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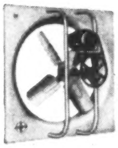
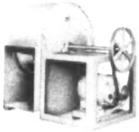
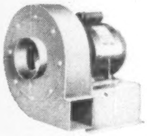
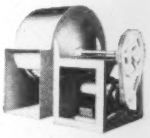
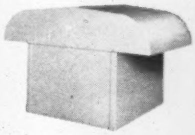
STURDY! . . . All welded construction. All material is 16 ga. or over. Built for the life of the building.

A COMPLETE LINE OF AIR MOVING EQUIPMENT

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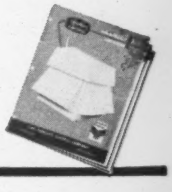
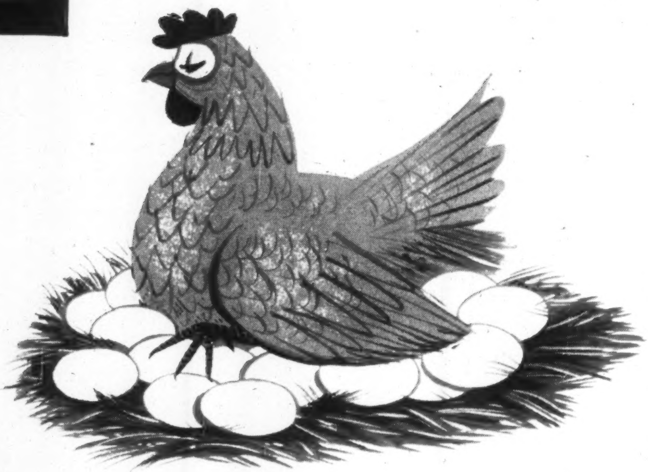


TOO LITTLE ON TOO MUCH—



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Getting the right size equipment for the job is important!

Brunner offers a complete line of Open-Type and Semi-Hermetic Condensing Units, in a wide range of sizes, to fit every refrigeration or air conditioning installation.

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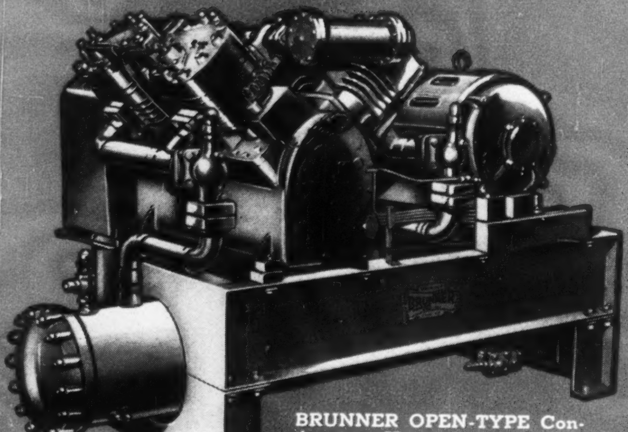

BRUNNER OPEN-TYPE Condensing Units from 1/4 H.P. through 100 H.P.
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FREON* REFRIGERANTS IN AIR CONDITIONING

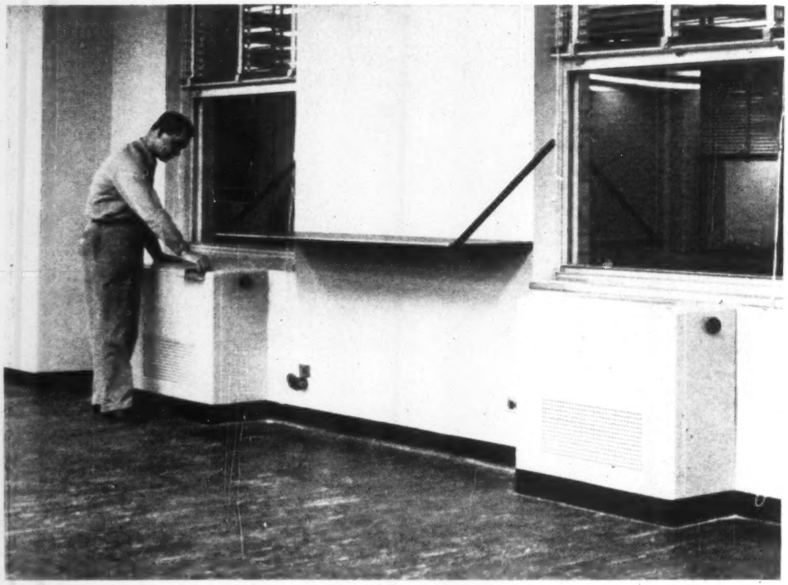
Field Reports About Successful Installations

Unit system combined with central system cools modernized building

An unusual dual air conditioning system was incorporated in the plans for interior modernization of the 15-story office building at 72 Wall Street, New York City. Architects Vorhees, Walker, Smith & Smith working with Contractors George A. Fuller Co. and J. H. Taylor Construction Co., Inc., designed a layout blending a Carrier duct-distributed, central system with a Remington Incremental System.

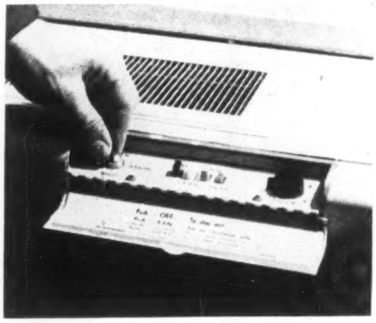
These systems divide the building's 665-ton cooling load at about half the installation cost of a full central system.

The Carrier system cools lower five floors plus interior of the top 10 floors. 459 Remington unit conditioners, built in under the windows, air condition peripheral offices of the top 10 floors. For installation of the Remington units, holes were cut in the masonry to receive air-intake ducts. Grillwork sets flush with the building and does not substantially alter its exterior appearance. (See above.)



Unit system in outside offices permits occupants to control temperatures for year-round comfort

Above shows how Remington units line the walls beneath windows in a typical office area at 72 Wall Street. Each cabinet houses a ¾- or 1-ton unit for cooling plus a separate heating coil connected to the building's steam system. Each unit incorporates a thermostat plus fan controls (shown right), which allow occupant to select the temperature he prefers year round. With this unit control system, heating or cooling can be economically confined to occupied areas without the need to air condition the entire building. The cooling unit is drawer-mounted and can be easily removed for maintenance or repair by simply disconnecting five wires.



Each Remington unit and the Carrier system uses "Freon" refrigerants to help insure effective performance with minimum maintenance.

How Du Pont leadership in refrigerants means better performance for installations you plan

Today's more compact, more efficient equipment has grown in part from Du Pont's pioneering in development and manufacture of improved "Freon" refrigerants. Improved manufacturing techniques developed by Du Pont make "Freon" the refrigerant that sets the industry's standard for purity and performance. That's why you can be sure the air conditioning and refrigerating installations you plan will deliver better performance when charged with "Freon". You can't select a better refrigerant than safe, acid-free, dry "Freon" refrigerant.

For data on applications, performance or properties of "Freon", write *E. I. du Pont de Nemours & Co. (Inc.), "Freon" Products Division #76, Wilmington 98, Del.*

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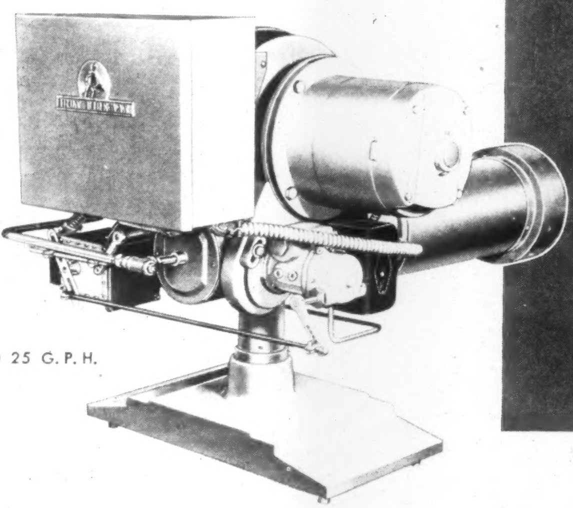

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MicroMist
TRADE MARK
BURNER

Two-stage atomizing principle reduces heavy oil to a microscopic mist

The first *REALLY NEW* oil burner in thirty years

Burns any fuel oil through heaviest No. 5. With the MicroMist low-pressure atomizing oil burner, heavy oils, through *heavy* No. 5, are reduced to minute particles having the characteristics of a gas rather than a spray. The oil is so finely divided that it becomes an oil mist or fog that will remain in air suspension for several hours. It is easily ignited by an electric spark (does not require gas ignition).

Two-stage atomizer. The heart of the Iron Fireman MicroMist burner is an ingenious supercharger, or compressor. This compressor-atomizer first reduces the oil to an air mixed spray (which is as far as other burners go), then by the heat of compression, to a microscopic air-oil vapor.

Heavy oils can't clog nozzle. The nozzle directs the highly combustible vapor into the firebox. Unlike other oil burners, the nozzle is *not* a critical part, because it has nothing to do with atomization. There are no small passages subject to clogging.

Heating of oil is required only for the heavier grades of No. 5, and then only for starting or pumping.

Look at these additional features. The Iron Fireman MicroMist burner is as easily installed as a conventional gun type burner. It has two important uses: as a conversion burner or as a component part of a packaged boiler-burner unit. No special boiler front or boiler pitting is required. The choice of oil grades is almost unlimited. Integral control panel is wired and tested at the factory. Fuel and maintenance costs are low. It fires low-cost heavy oils with little more attention than a domestic oil burner. Available for low fire start, high-low or modulating firing.

The Iron Fireman MicroMist burner is ideal for commercial heating installations. Mail coupon for more information.

Po'keepsie Motor Hotel provides heat and hot water through winter at a cost of 13 cents per day per room

Mr. Charles Michel, manager, writes:

"Our Iron Fireman MicroMist burner uses an inexpensive, No. 4, oil in our 53-room deluxe motel. From October 1, 1956 to March 1, 1957, our fuel bill for the heating and domestic hot water amounted to $1,233.00, or 13c per room per day.

"This burner has not required daily attention and the overall maintenance cost has been extremely small."

The steam heating system in the Po'keepsie Motor Hotel uses the revolutionary Iron Fireman SelecTemp room heating units with individual room temperature control—"a thermostat in every room." SelecTemp heating is used in conjunction with individual room cooling units.

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Automatic firing equipment for oil, gas, coal

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Please send literature and specifications on the Iron Fireman MicroMist burner.

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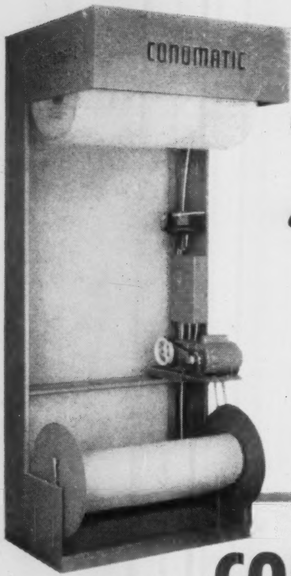


with CONTINENTAL

SUPERIOR ENGINEERING...

clear the air MORE EASILY—MORE ECONOMICALLY

First with its Automatic Self-Cleaning Air Filters, and then with other types of air filters in rapid succession. Continental has repeatedly introduced new and better engineering features to provide clean air with a minimum of cost and maintenance attention.

CONOMATIC

(Roll-Away Air Filter)

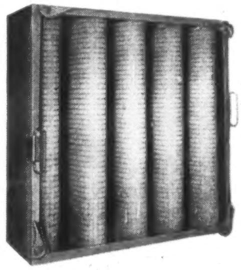
The most recent addition to the Continental Air Filter line provides more effective filter area for its size than any competitive filter. Reduces moving parts to a simple minimum. Provides positive, automatic controls.

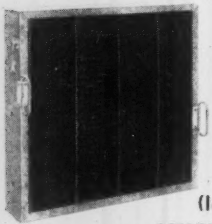
DYCON CA-24

AND CA-20

(Permanent dry type panel filters)

Just rinse and re-use! Simplest maintenance ever. Several times the dust-holding capacity of other filters in their class.

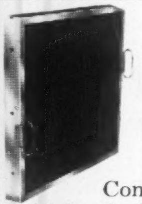




LV 2 and LV 4

(low velocity, screen-wire type)

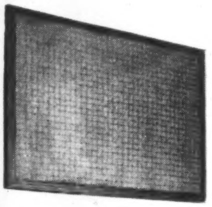
For highly satisfactory, low-cost air filtration. Sturdy and rust-resistant.



E-Z-WASH

(Permanent viscous unit filter)

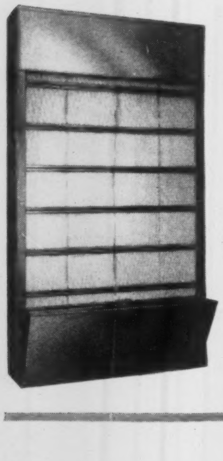
Continental's patented high-velocity E•Z•Wash media gives this filter continued low resistance with huge dust-holding capacity. Eliminates surface loading and assures easy cleanability.



DYCON DY

(1″ dry type unit filter)

Another "rinse and re-use" Continental air filter. Excellent for air handling units or for pre-filter use.



AUTOMATIC SELF-CLEANING

Continental's Automatic adapts the superior, patented E•Z•Wash media to the continuous, self-cleaning filter curtain, and introduced the important ferris wheel principle to eliminate reversing the media to air-flow in the rear curtain.

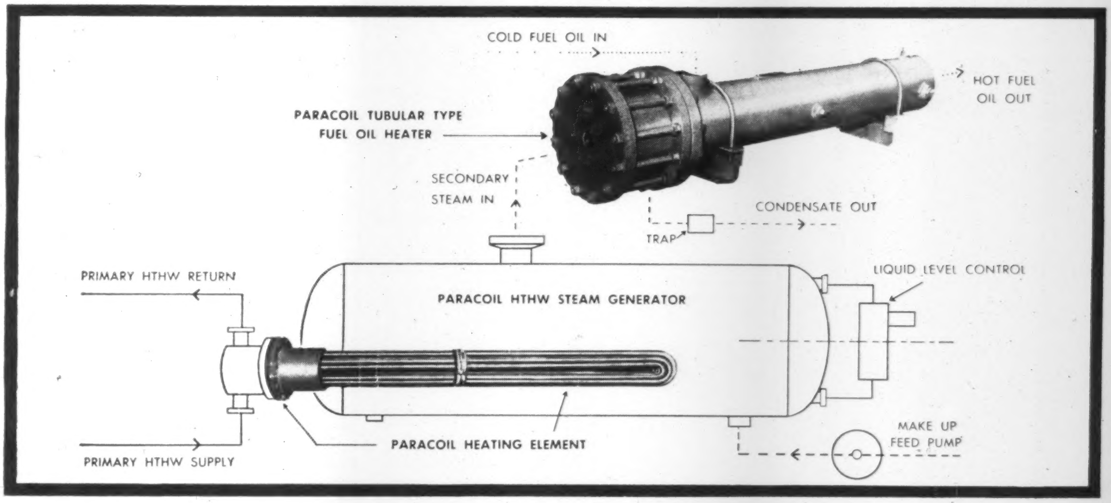
For your filter needs, call your nearest Continental representative to "clear the air", or write direct to:

AIR CONTINENTAL FILTERS

CONTINENTAL
AIR FILTERS, Inc.
P. O. BOX 1647 LOUISVILLE 1, KY.

CUT ALONG DOTTED LINE AND SAVE

Idea no. 1 from Paracoil


COLD FUEL OIL IN
HOT FUEL OIL OUT
PARACOIL TUBULAR TYPE FUEL OIL HEATER
SECONDARY STEAM IN
CONDENSATE OUT
TRAP
LIQUID LEVEL CONTROL
PRIMARY HTHW RETURN
PARACOIL HTHW STEAM GENERATOR
PARACOIL HEATING ELEMENT
MAKE UP FEED PUMP
PRIMARY HTHW SUPPLY

How to use secondary steam to pre-heat no.6 oil in a High Temperature Hot Water system

Paracoil engineers know that the first consideration in the design of an oil preheating system for an HTHW installation must be absolute freedom from the possibility of oil leak contamination of the main HTHW stream. A completely isolated oil preheater circuit is recommended. This can be accomplished by means of a secondary heat transfer circuit that does the actual heating. In this way, only the secondary circuit is exposed to possible contamination — the main HTHW circuit is protected at all times.

One of the ways that this isolation is achieved is illustrated above. Additional isolation circuits will be commented upon in future "Idea Sheets". Watch for them!

How to design a protective circuit

1. **Install a steam generator.** Use a Paracoil Heating Element with the HTHW main energy stream as its heat source. With water at 350° F, steam at 25 psig (267° F) can be easily generated in an economically sized unit.
2. **Use the steam thus generated** . . . to heat the fuel oil in a Paracoil Tubular Oil-Type Fuel Oil Heater.* This type heater provides the highest rate of heat transfer — more than **three times** that of the conventional straight tube type.
3. **The condensate from the oil heater** . . . may be returned to the steam generator or sent to waste depending upon plant policy. If the re-use of the condensate is important, absolute surety of its quality can be obtained through the use of the Paracoil Oil Leak Condensate Inspection System.*

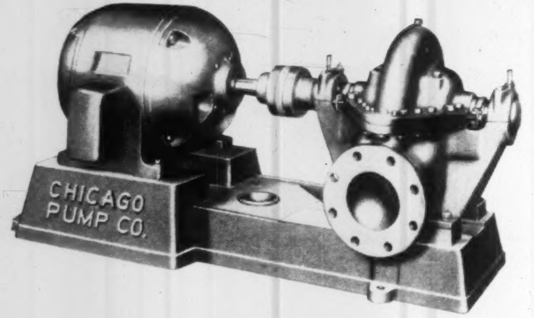
Paracoil engineers have designed and built many oil preheater protective systems for both stationary and marine installations. They now offer their experience and know-how to all who are involved in HTHW activities. ***Write for complete data.***

DAVIS ENGINEERING CORPORATION
30 Rockefeller Plaza, New York 20, New York • Circle 6-5650

FROM

Chicago TOP QUALITY PUMPS

Engineered for plumbing, heating, and air conditioning systems

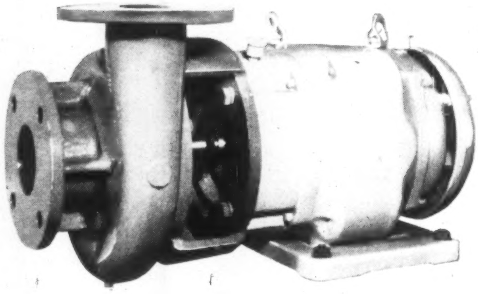


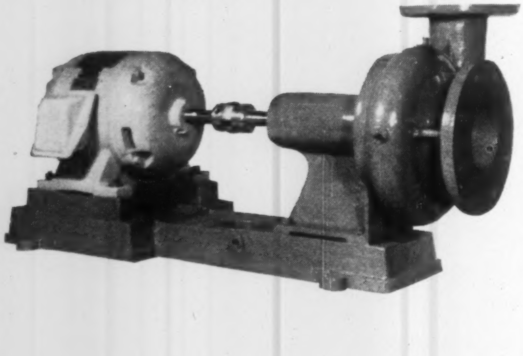
TYPE D DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP

A rugged, heavy-duty pump that guarantees long, trouble-free service. The rotating assembly may be inspected without disconnecting the piping. Capacities up to 1900 G.P.M. Heads to 530 Ft. Described in Bulletin 101.

TYPE CC CLOSE COUPLED PUMP

Handles the toughest pumping jobs efficiently and in the least possible space. May be mounted in any position as long as the motor is not lower than the pump. Equipped with leak-proof mechanical seal. Capacities up to 500 G.P.M. Heads to 215 Ft. Described in Bulletin 108.





TYPE FC PEDESTAL MOUNTED FLEXIBLE COUPLED PUMP

Like the CC, all FC pumps are equipped with the most reliable mechanical seal ever built into a pump. Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. Described in Bulletin 107.

For trouble-free, "worry-proof," efficient pumping at all times — specify Chicago Pumps. Write for complete information.

fmc FOOD MACHINERY AND CHEMICAL CORPORATION ®

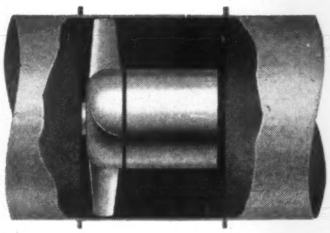
CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

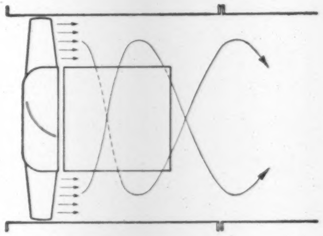
BUILDING PUMP DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

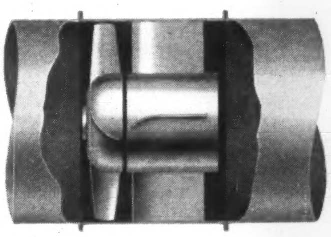
Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps, Pumps for every Industrial use.



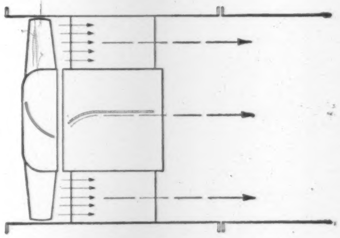
The tubeaxial fan . . . a wide range of volumes at medium pressures, with uniform velocity . . .



. . . at moderate pressures the spiral air discharge straightens out a short distance from fan blades.



The vaneaxial fan . . . stationary guide vanes reduce turbulence and increase fan efficiency . . .



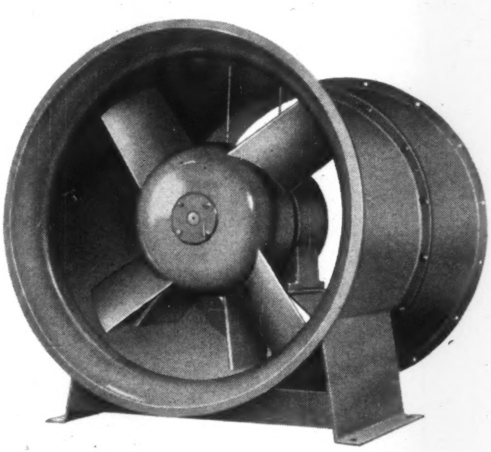
. . . resulting straight-line air flow leaving fan assures smooth, quiet operation for all conditions.

Easy-to-install American Blower axial fans save space, lower your installation cost

American Blower axial fans provide straight-line air flow, eliminating elbows, bends, and transformation pieces—can be installed vertically or horizontally in ducts, with minimum foundations and supports . . . with savings in space, first cost, handling, and installation.

These compact, self-contained axial fans are available in three general designs—vaneaxial for direct and V-belt drive, spray-booth vaneaxial for V-belt drive, tubeaxial for direct drive. A complete line of accessories is offered to adapt this versatile line of fans to your particular requirements. Capacities range from 2,500 cfm to 75,000 cfm. Larger sizes are available on special order.

For more information on axial fans, or on other equipment from American Blower's complete air-handling and -conditioning line, call our nearest branch office, or write direct to American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.



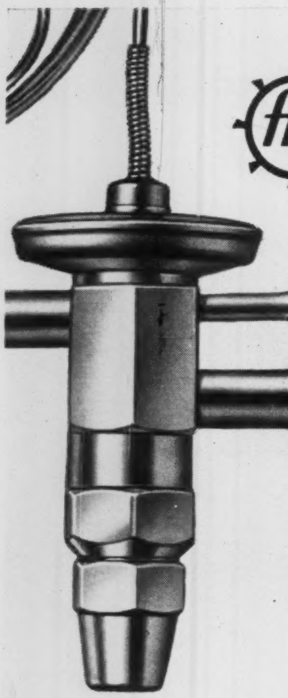
Versatile American Blower axial fans can be mounted vertically or horizontally. When ducts are properly reinforced, the fan can be supported directly by the duct connection.

AMERICAN BLOWER

Division of American-Standard

never before . . .

so many controls and services to make you fully competitive!



MODEL 214
thermostatic expansion valve

CONTROLS COMPANY OF AMERICA, *first name in quality controls, now offers you combined research, engineering and production facilities to solve any control problem in this field.*

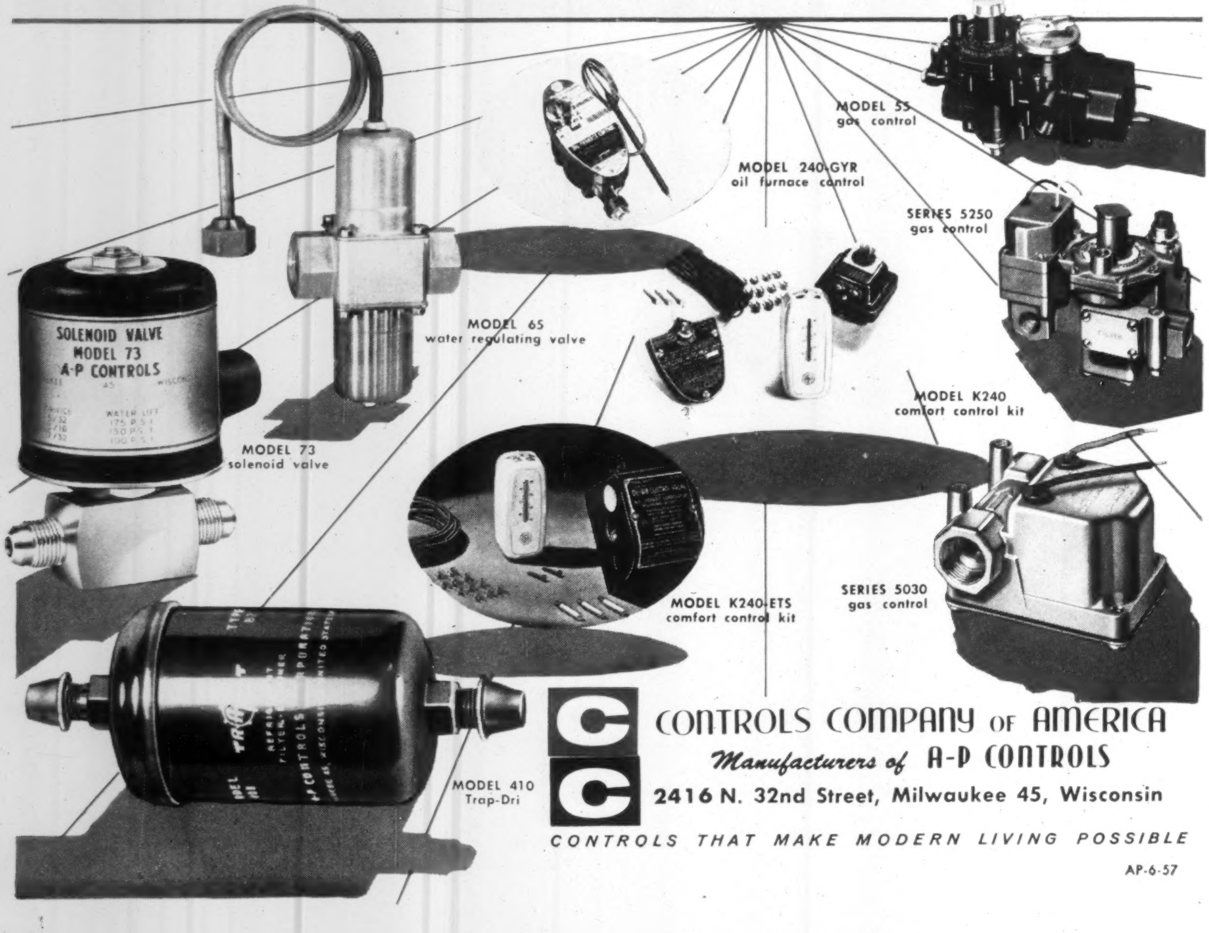
WE'LL guess that you've never really known the full breadth of the line of A-P Controls we offer you — and we make no attempt here to show them all. Just this — whatever your application: air conditioning, refrigeration, ventilation, oil heating, gas heating and cooking — scores of "years ahead" controls are immediately available from nearby stocking jobbers. In the refrigeration and air-conditioning field alone — A-P serves you with more than 400 authorized stocking jobbers. And there's the invaluable backing of a nation-wide network of service stations whenever desired.

Very often we're called in to help solve a control problem and the solution invariably turns out to be a strong competitive advantage for the customer. To have the last word in competition, call in A-P, the first name in quality controls.

AIR CONDITIONING AND REFRIGERATION

OIL HEATING

GAS HEATING AND COOKING



MODEL 55
gas control
MODEL 240-GYR
oil furnace control
SERIES 5250
gas control
MODEL 65
water regulating valve
SOLENOID VALVE
MODEL 73
A-P CONTROLS
MODEL 73
solenoid valve
MODEL K240
comfort control kit
MODEL K240-ETS
comfort control kit
SERIES 5030
gas control
MODEL 410
Trap-Dri

CC

CONTROLS COMPANY OF AMERICA

Manufacturers of A-P CONTROLS

2416 N. 32nd Street, Milwaukee 45, Wisconsin

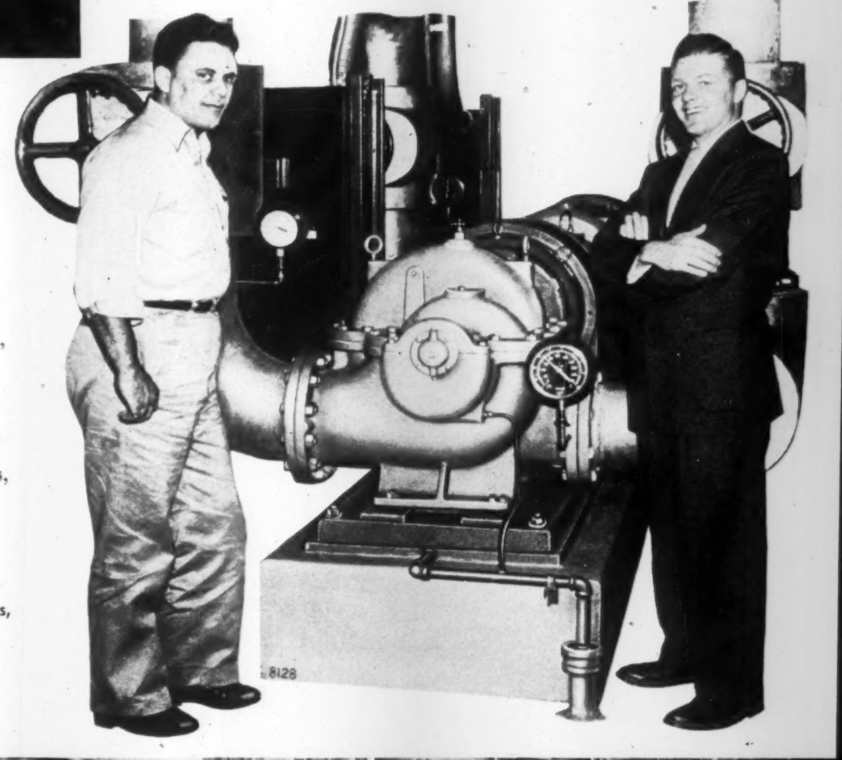
CONTROLS THAT MAKE MODERN LIVING POSSIBLE

AP-6-57

DE LAVAL

CENTRIFUGAL PUMPS

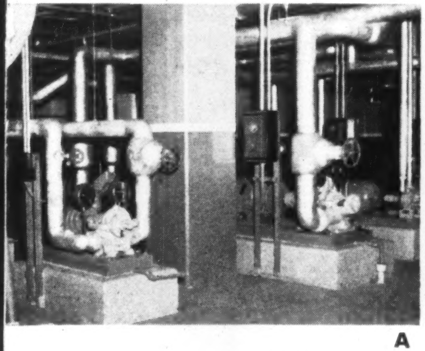
selected by contractor for "long service at low cost"



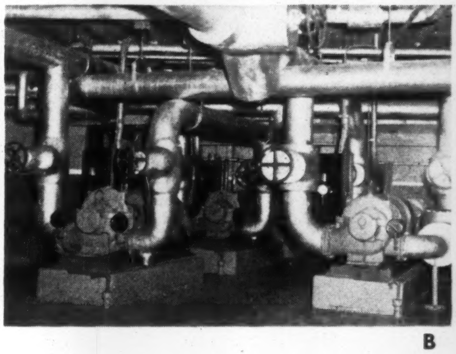
Ten De Laval centrifugal pumps were installed in the new Shell Oil Building, New Orleans, La. by Emile M. Babst Company, the Mechanical Contractor. "De Laval pumps were selected," Babst reports, "because we know that we can count on their dependability. They are built to give long service at low cost."

De Laval single stage centrifugal pumps are being used for a wide variety of applications in commercial and industrial buildings. For complete data on these units, write for Bulletin 1002.

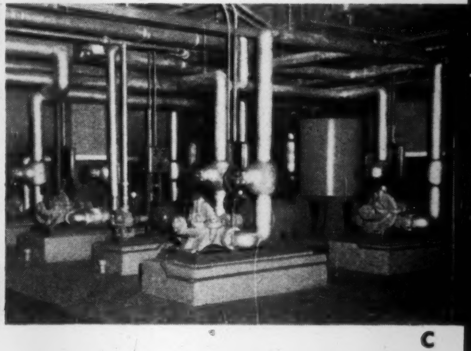
Shown are Edmund Dolese, Chief Building Engineer (at left) and Robert Ralston of the Emile M. Babst Company, Mechanical Contractor (at right). Architects—August Perez & Associates, Consulting Engineers—Leo S. Weil & Walter B. Moses, General Contractor—Gervais F. Favrot Co., Inc.



A



B



C

The new 14-floor Shell Oil Building in New Orleans has 300,000 sq. ft. of rental area, which is occupied by 45 tenants.

A Two De Laval GS pumps are used for hot water circulating. They operate at 75 gpm and 30 ft. head.

B Four De Laval K pumps are used for coil water service (1800 gpm and 168 ft. head) and condenser water service (2480 gpm and 130 ft. head).

C Four De Laval I pumps are used for cooling tower make-up (115 gpm and 145 ft. head) and house pump service (270 gpm and 174 ft. head).

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

871 Nottingham Way, Trenton 2, New Jersey

DL-368

When piping changes direction, protect process equipment with

ZALLEA SELF EQUALIZING UNIVERSAL EXPANSION JOINTS

Zallea Self Equalizing Universal Expansion Joints absorb any movement in any direction . . . axially, laterally, angularly, or any combination of these . . . making them ideal for protecting process vessels and rotating equipment from thermal expansion of connected piping.

When there is a leg or 90° offset to a long run of pipe, one Zallea Universal Expansion Joint will frequently take care of the entire system.

Under conditions of low load requirement for anchors or equipment . . . or when compressive loading in pipe walls must be kept to a minimum . . . Zallea Universal Expansion Joints are the most economical answer to the problem. They absorb the internal pressure thrust. The piping system need only carry the relatively small deflection loads.

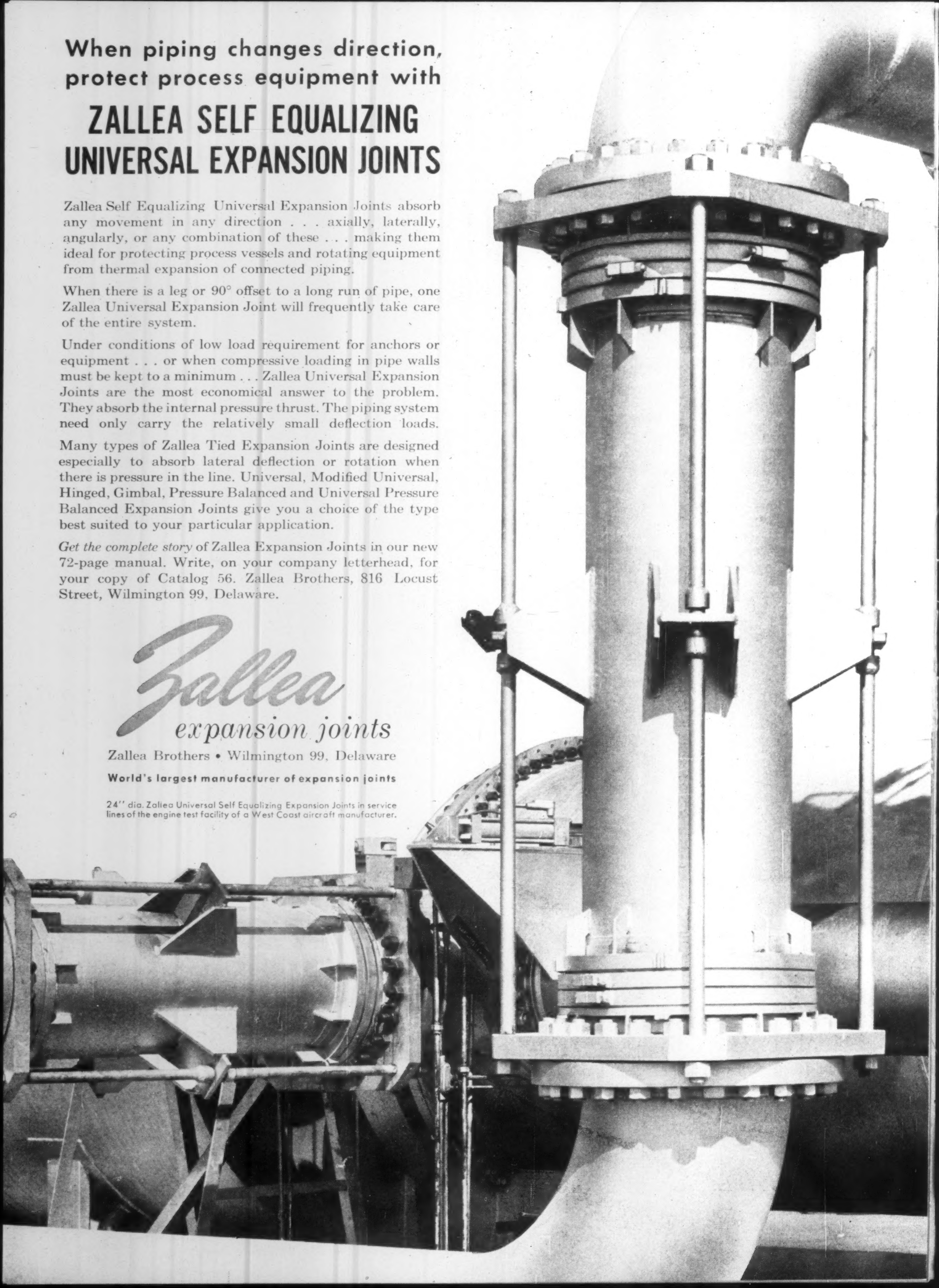
Many types of Zallea Tied Expansion Joints are designed especially to absorb lateral deflection or rotation when there is pressure in the line. Universal, Modified Universal, Hinged, Gimbal, Pressure Balanced and Universal Pressure Balanced Expansion Joints give you a choice of the type best suited to your particular application.

Get the complete story of Zallea Expansion Joints in our new 72-page manual. Write, on your company letterhead, for your copy of Catalog 56. Zallea Brothers, 816 Locust Street, Wilmington 99, Delaware.

Zallea
expansion joints

Zallea Brothers • Wilmington 99, Delaware

World's largest manufacturer of expansion joints



24" dia. Zallea Universal Self Equalizing Expansion Joints in service lines of the engine test facility of a West Coast aircraft manufacturer.

mystified about getting stainless steel pipe?

CALL YOUR REPUBLIC ELECTRUNITE DISTRIBUTOR

He's no magician, but he is a specialist in solving stainless steel pipe problems. Just tell him yours and he will fill the bill promptly, with the exact sizes and types required.

There's no mystery about getting genuine Republic ELECTRUNITE® Stainless Steel Pipe and Tubing, either. Each length in your distributor's stock is clearly stenciled from one end to the other with the type, heat number, and specification. Even when cut, identification stays intact.

Joining-problems require no trick solutions. Republic ELECTRUNITE Stainless Steel Pipe can be welded or connected with threaded or compression-type fittings, also available through your distributor.

Republic ELECTRUNITE Stainless Steel Pipe is available in Types 304, 304-L, 316, 316-L, 321 and 347—plus other analyses. Continuous welded sizes from ⅛" I.P.S. through 2" I.P.S. in A.S.A. schedule 40S; from ⅛" I.P.S. through 4" I.P.S. in schedule 10S; and from ½" I.P.S. through 4" I.P.S. in schedule 5S wall thicknesses. Larger sizes up to 30" also available. Republic Stainless Steel Tubing also comes in a complete range of sizes and analyses.

Let your Republic ELECTRUNITE distributor take the mystery out of quality stainless steel pipe and tubing supply problems.

He's as near as your telephone—and anxious to serve you. Or, for more information, send coupon.

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STEEL AND TUBES DIVISION

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CALIFORNIA
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CONNECTICUT
Peter A. Frasse and Co., Inc. Hartford

GEORGIA
Atlantic Steel Company, Atlanta
McJunkin Corp., Atlanta

ILLINOIS
Chicago Steel Service Co., Chicago
Chicago Tube and Iron Co., Chicago
Creamery Package Co., Chicago

KENTUCKY
McJunkin Corp., Louisville
Williams and Company, Inc., Louisville

MARYLAND
Hill-Chase Steel Co. of Maryland, Baltimore

MASSACHUSETTS
Springfield Plumbing Supply Co., Springfield

MICHIGAN
Kenneth Anderson Company, Detroit
Lansing Supply Co., Inc., Lansing

MISSOURI
Marsh Steel Corp., North Kansas City

NEW JERSEY
A. B. Murray Co., Inc., Elizabeth

NEW YORK
W. A. Case & Son Co., Inc., Buffalo
Peter A. Frasse and Co., Inc., Buffalo
Peter A. Frasse and Co., Inc., Syracuse
Peter A. Frasse and Co., Inc., New York
K. & S. Metal Supply, Inc., Long Island City

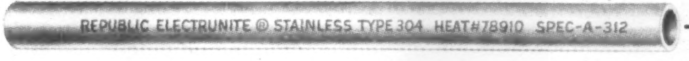
OHIO
McJunkin Corp., Columbus
Williams and Co., Inc., Cincinnati
Williams and Co., Inc., Cleveland
Williams and Co., Inc., Columbus
Williams and Co., Inc., Toledo

PENNSYLVANIA
Peter A. Frasse and Co., Inc., Philadelphia
Hill-Chase and Co., Philadelphia
A. B. Murray Co., Inc., Bristol
Williams and Co., Pittsburgh

TENNESSEE
Metals, Inc., Bristol
Vance Iron and Steel Co., Chattanooga

TEXAS
The Baldwin Co., Houston

VIRGINIA
John Frishchkorn, Richmond
Mize Supply Co., Waynesboro


REPUBLIC ELECTRUNITE ® STAINLESS TYPE 304 HEAT#78910 SPEC-A-312

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Steel and Tubes Division
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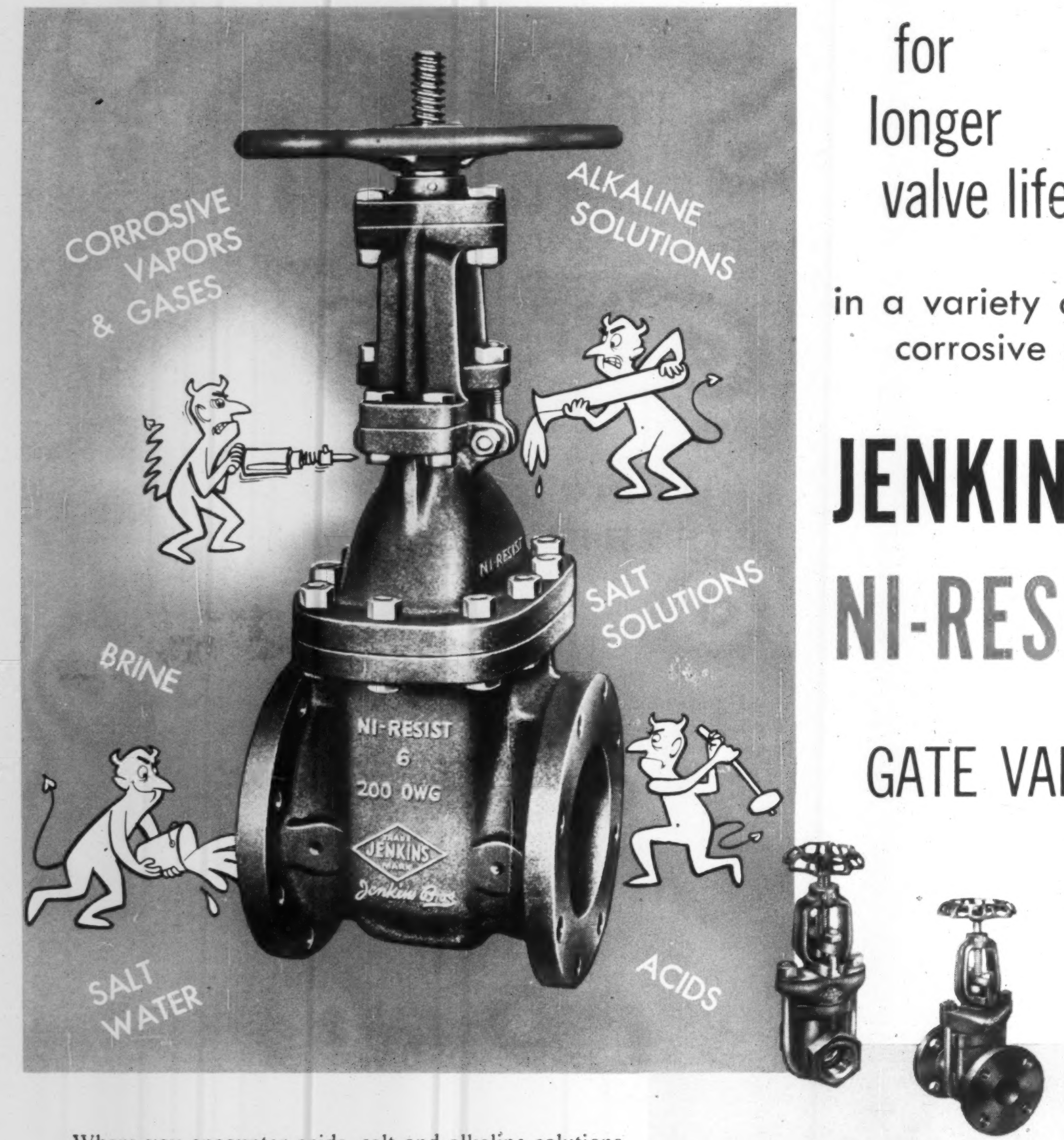

CORROSIVE VAPORS & GASES
ALKALINE SOLUTIONS
SALT SOLUTIONS
BRINE
SALT WATER
ACIDS
NI-RESIST
NI-RESIST
6
200 OWG
TRADE JENKINS MARK
Jenkins Bros

for longer valve life

in a variety of corrosive services

JENKINS NI-RESIST

GATE VALVES

Where you encounter acids, salt and alkaline solutions, sea water, brine or other corrosive fluids, vapors or gases, you'll want Jenkins Ni-Resist Type 2 Cast Iron Gate Valves with type 316 stainless steel trim. They have a remarkable ability to withstand destructive corrosion and erosion.

In paper mill service, food processing, petroleum refining, chemical plants and other process industries, Jenkins combination of Ni-Resist type 2 cast iron and type 316 stainless steel, plus Jenkins extra *value* construction throughout greatly extends valve life.

Designed especially for corrosive services, the Jenkins Ni-Resist line of gate valves also has superior metal-to-metal wearing qualities. Copper-free, they will not discolor or contaminate products being carried in the line. Let the famous Jenkins Diamond be your guide when choosing Ni-Resist valves . . . it means longer, trouble-free service.

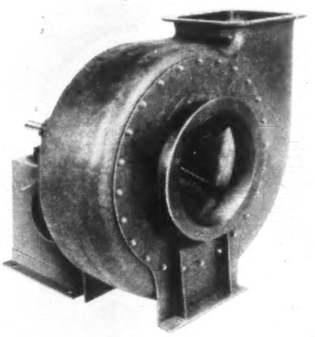
GET COMPLETE INFORMATION
from your Jenkins Distributor, or write Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
TRADE JENKINS MARK
SINCE 1864
Jenkins Bros

Sold Through Leading Industrial Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 260



Fans . . .

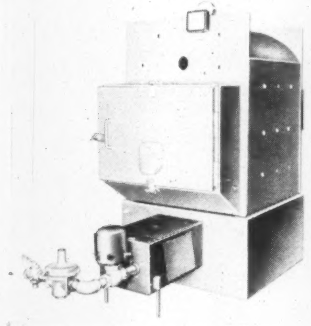
. . .designed for severe corrosive air handling jobs—*Buffalo Forge Co., Dept. HPAC, 490 Broadway, Buffalo 5, N.Y.*

Corrosion resistant, impact resistant, resin bonded glass fiber fans will not support combustion, says company. "FG" units are said to afford chemical resistance to wide variety of acids, salts, gases, organic materials, other corrosives in temperature applications to 225 F. Cited features: increased versatility, lighter weight, reliability. Available in standard capacities to 34,000 cfm at pressures to 10 in. static.

Evaporative Condensers . .

. . .in new series with capacities to 200 tons—*Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

"Flow-Mizer" units incorporate zig-zag cross-sectional coil spacing with phenolic spacers. Are said to offer maximum condensing efficiency with 97 percent water savings in air conditioning, industrial liquid cooling. Improved turbulence, heat transfer achieved with staggered, cross-sectional spacing of tubes, says company.



Gas Heating Boilers . . .

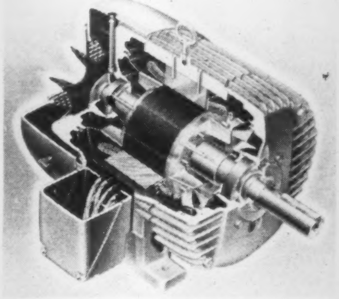
. . .for natural, manufactured, mixed gases—*Portmar Boiler Co., Dept. HPAC, 193 Seventh St., Brooklyn.*

"Commodore" units designed to meet heating, hot water supply requirements of small commercial installations. ASME code constructed and stamped, says company. Cited feature is double-pass fire travel through many heavy gage staggered boiler tubes. In nine sizes with net steam ratings to 2200 sq ft, net forced water ratings to 3960 sq ft.

Rotary Pumps . . .

. . .for commercial oil burner service—*Tuthill Pump Co., Dept. HPAC, 939 E. 95th St., Chicago.*

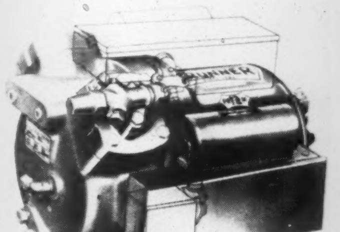
Designed for handling less expensive residual heating oil grades (Nos. 4, 5, 6) involving pressures to 250 psi, capacities to 2000 gph, operating temperatures to 200 F, direct motor speeds to 1750 rpm.



A-C Induction Motors . . .

. . .in 40 to 125 hp capacities—*General Electric Co., Dept. HPAC, Schenectady 5, N.Y.*

Line built to new NEMA standards which assign greater hp to given motor frame size, says company. Available in open dripproof models for standard applications, totally enclosed fan cooled units for use in corrosive atmospheres. Cited features: higher efficiency per pound of motor weight, quieter operation, reduced maintenance, improved lubrication system designed to protect bearing housing from entry of dirt. Shown is cutaway view of totally enclosed fan cooled model.



Refrigeration Condensing

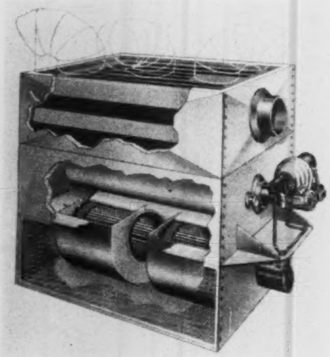
. . .units with optional control panel locations designed to increase flexibility—*Brunner Div., Dunham-Bush, Inc., Dept. HPAC, 29 Fisher St., Utica, N.Y.*

Panel may be located either on

EQUIPMENT DEVELOPMENTS

Continued

side or top of semi-hermetic units in ¼, 1/3, ½, 1 hp sizes, says company. Fhp units are air cooled, water cooled, or combination. Compressors are said to have positive splash lubrication. Units spring mounted to reduce compressor vibrations, crank shaft dynamically and statically balanced for smooth operation, manufacturer states.



Oil, Gas Fired Heaters . . .

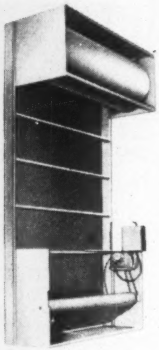
. . . in capacities 225,000 to 1,100,000 Btu—*Campbell Heating Co., Dept. HPAC,* 3121 *Dean Ave., Des Moines* 17, *Iowa.*

"U" series heaters available with same basic components factory assembled in horizontal, vertical models. Both types readily adaptable for use as unit heaters or for duct systems, says company. Because of ease of bypassing heating unit, heaters are said to be especially adaptable for installation of cooling coils.

Centrifugal Chillers . . .

. . . in 150, 200, 250, 300, 400, 500 hp capacities—*Airtemp Div., Chrysler Corp., Dept. HPAC,* 1600 *Webster St., Dayton* 1, *Ohio.*

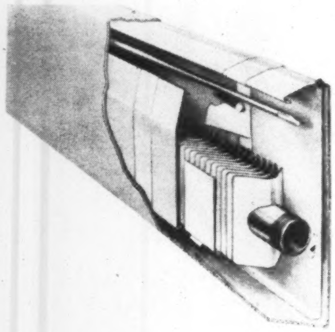
Cited features: completely automatic control, accessible hermetic construction of compressor and motor assembly, sealed two-stage centrifugal compressor, balanced thrust in compressor and motor assembly, pushbutton starting and stopping with capacity automatically adjusted to load variations, compact design, quiet operation.



Dry Air Filter . . .

. . . with glass fiber media which extends from clean media roll at top of unit, over filter face of unit, onto used media takeup roll at bottom —*Farr Co., Dept. HPAC, P.O. Box* 45187 *Airport Sta., Los Angeles* 45.

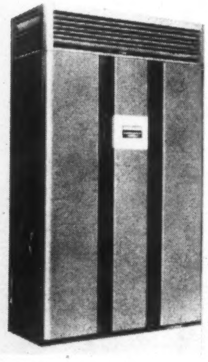
"Roll-Kleen" operates as follows, says company: When instruments sense that airflow through media has dropped to allowable preset limits due to accumulated dirt, takeup roll automatically pulls clean media over entire filter face. Is said to assure even air distribution across face of filtering area. Units in 3, 4, 5 ft widths, with heights ranging 5 to 15 ft.



Baseboard Radiator . . .

. . . engineered for one- and two-pipe steam heating systems, hot water heating applications—*Slant-Fin Radiator Corp., Dept. HPAC, Richmond Hill, N. Y.*

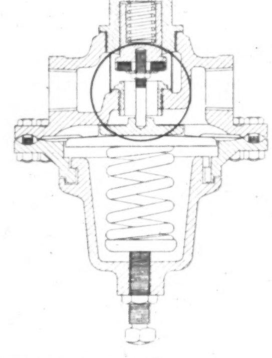
Consisting of 1¼ in. IPS steel pipe with "V" design steel fins, "Steel-Pak" unit is furnished in precut packages of 3, 4, 5, 6, 8 ft lengths, complete with enclosure, slide hangers, damper, splice plate. Threaded pipe ends, welded support bracket, snap-on front cover are said to reduce installation labor because no special tools or techniques are required. Cited feature is slide-action track expansion clips that can be adjusted for pitch and permit free, noiseless thermal expansion, says company.



Air Conditioner . . .

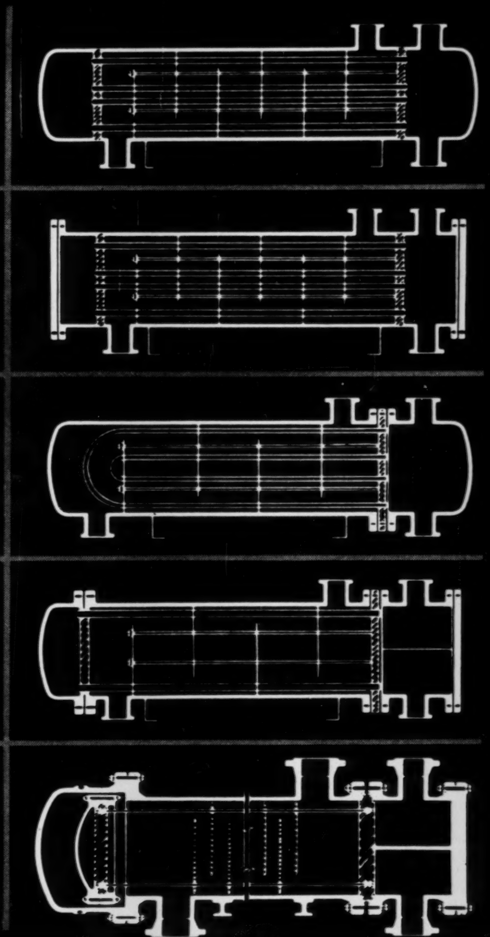
. . . for commercial applications—*Worthington Corp., Dept. HPAC, Harrison, N.J.*

Packaged "SAC" designed to work solely as air cooled unit. Cited features: hermetic air cooled compressor that eliminates need for conversion; air cooled, weatherproofed condenser with high capacity blower and motor; "lifetime" lubricated bearings on fan, fan motor; automatic switch for temperature control. Units available to operate on 208, 220, 440 or 550 volts, a-c. In 3, 5, 7½ hp models.



Pressure Regulator . . .

. . . with larger through passage designed to give greater capacity, less turbulent flow pattern through valve



Here's How to Check Corrosion, Prevent Product Contamination

When you have problems of corrosion and product contamination in your heat exchangers and condensers, then it's time to specify B&W Tubing. In an extensive range of processes where these points are key factors, the selection of the best tube steel analysis for the best performance is, in every case, your first requirement.

Because B&W Heat Exchanger and Condenser Tubing is made in a wide variety of carbon, alloy, and stainless steel grades, seamless or welded, and in a full range of combinations of diameters and wall thicknesses to meet practically every requirement, you can select the most economical and dependable tubing for your specific application. Designers prefer B&W Tubing and shop men know from on-the-job experience that it's easy to bend, to roll-in, and to weld.

Call on Mr. Tubes at your nearby B&W Tubular Products Division District Sales Office—let him help you solve your heat exchanger or condenser tube problems. Write for bulletin 329. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

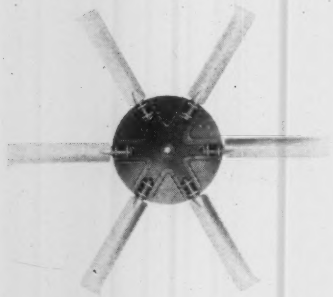
B&W
TUBULAR PRODUCTS DIVISION

TA-7006-PG3

Seamless and welded tubular products, seamless welding fittings and forged steel flanges — in carbon, alloy and stainless steels

—*Davis Regulator Co., Dept. HPAC, 2541 S. Washtenaw, Chicago 8.*

Cited feature is interchangeable discs which facilitates quickly changing from water service, for example, to steam, gas, or air. Spring adjustment made from below rather than from above, as added safety factor, says company. Reduced pressure range is 1 to 100 psi, depending on size, with initial pressure to 400 psi. With built-in strainer. In bronze, semi-steel, or steel body with alloy trim. Sizes are ⅜, ½, ¾, 1, 1¼, 2 in.



Propellers . . .

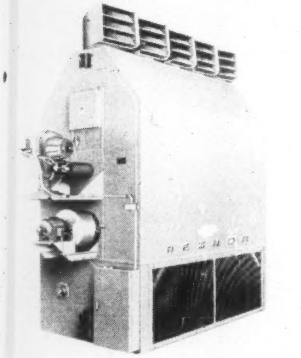
. . . for cooling towers, heat exchangers—*Aerovent Fan Co., Inc., Dept. HPAC, Piqua, Ohio.*

Large diameter "Al-metal" units, with cast aluminum blades, engineered to move maximum volumes of air with minimum power consumption. Blades individually balanced to permit interchangeability in any assembly, speed and simplify installation and maintenance, says company. Available with 4 or 6 blades, in diameters 14 to 18 ft. For single or multiple pitch operation.

Space Heaters . . .

. . . in capacities 400,000 to 2 million Btu—*Reznor Mfg. Co., Dept. HPAC, Mercer, Pa.*

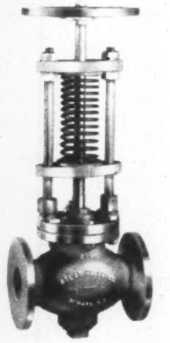
Stainless steel, direct fired units may be equipped with gas, oil or dual fuel burners. Designed to operate with fuel oils through No. 5 grade, or natural, mixed, manufactured or LP gas. Combination units can be supplied with interchangeable burners or with single burner adaptable to second fuel by flicking switch, says company. For top, bottom or horizontal discharge. Are said to be easily adapted for use in duct systems.



Air Conditioner . . .

. . . in 20 hp. water cooled packaged unit—*Carrier Corp., Unitary Equipment Div., Dept. HPAC, Syracuse 1, N.Y.*

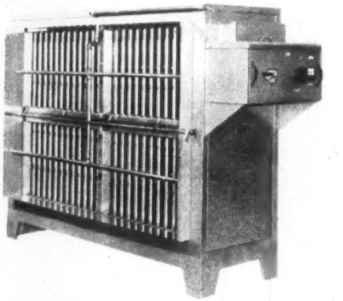
"Weathermaker" equipped with compact filter frame, uses high velocity filters which are easily removed for cleaning, says company. Cited feature is opening to which outside air duct can be connected without taking up additional floor space. Prewired electrical center designed to save installation time, cost by grouping controls in convenient location.



Valve . . .

. . . designed to function on both condensing, noncondensing systems—*Atlas Valve Co., Dept. HPAC, 280 South St., Newark 5, N.J.*

Spring loaded relief and back pressure unit used in condensing systems to maintain constant back pressure in exhaust line from auxiliary engine or turbine, says company. On condenser of auxiliary equipment unit functions as relief valve if vacuum is lost. In noncondensing systems, valve serves as back pressure control valve. In sizes 2½ to 6 in., with adjustable ranges 5 to 35 psi.



Electronic Air Cleaners . . .

. . . in three new models added to company's "Compact" line—*Electro-air Cleaner Co., Inc., Dept. HPAC, 1285 Reedsdale St., Pittsburgh 33.*

Two units have greater air cleaning capacity than any of nine models formerly comprising line, says company. Third unit augments existing models. Models and air cleaning capacities are: "132-H"—3200 to 4000 cfm; "160-H"—6000 to 7200 cfm; "180-H"—8000 to 9600 cfm.

Cooling Towers . . .

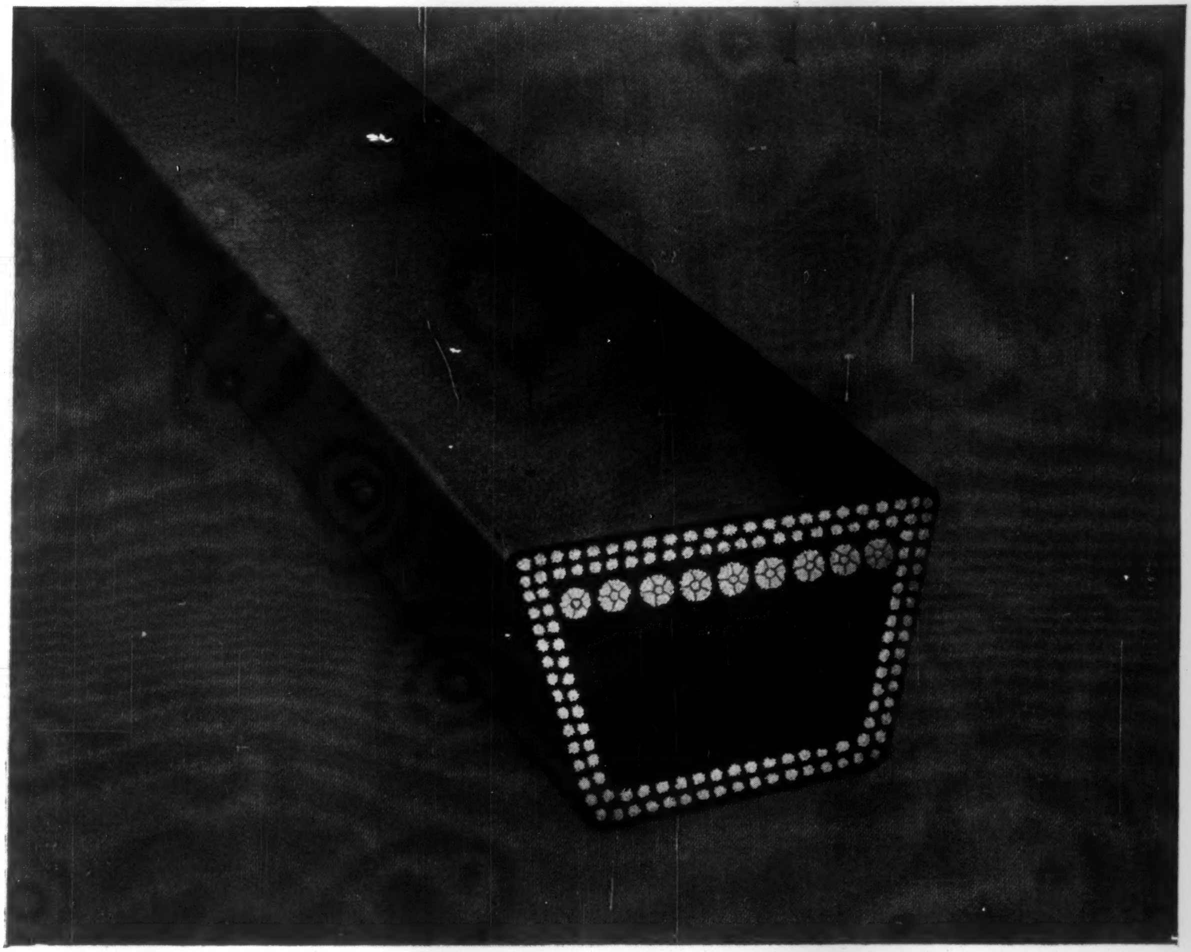
. . . in line of small tonnage models—*Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

Capacities range from 3 to 20 tons. Cited feature is company's new plastic "Pak," said to be lightweight and free from rot, rust, and other deterioration and have high level of water cooling efficiency. Unit consists of polystyrene sheet held in galvanized metal frame container.

Safety Device . . .

. . . engineered to protect rotating, reciprocating machinery by anticipating malfunctions—*Fielden Instru-*

V-BELTS

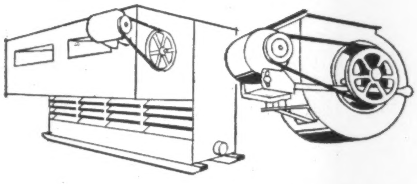


Quiet . . . smooth . . . vibration at the vanishing point

Unerring electronic controls; new methods of curing; the facilities of the largest and most modern plant devoted exclusively to the manufacture of endless transmission belts—these are the factors that bring to the heating and air-conditioning industry the one V-belt that erases vibration to the vanishing point.

The U. S. V-belt contributes greatly to the silent and efficient operation of fans, pumps, compressors, blowers—large or small—wherever power transmission is required for air-conditioning and refrigeration units.

Contact any of the 28 "U. S." District Sales Offices, or selected distributors, or write us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.



Mechanical Goods Division

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Repair it??
Will it Last??

ELIMINATE

- rusting
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- unsightliness

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Please send copy of Draft Inducer Bulletin I-57.
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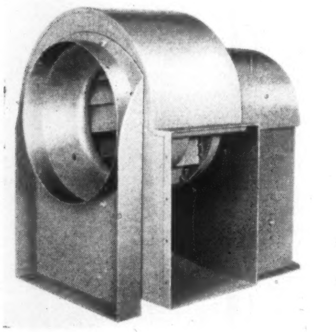
City.......................Zone.......State..........

EQUIPMENT DEVELOPMENTS

Continued

ment Div., Robertshaw-Fulton Controls Co., Dept. HPAC, 2920 N. Fourth St., Philadelphia 33.

"Vibraswitch" detector automatically shuts down protected equipment, or sounds alarm when normal operating vibration is exceeded, says company. Cited applications: pumps, motors, compressors, centrifuges, generating equipment, fans, blowers, engines, turbines.



Utility Set . . .

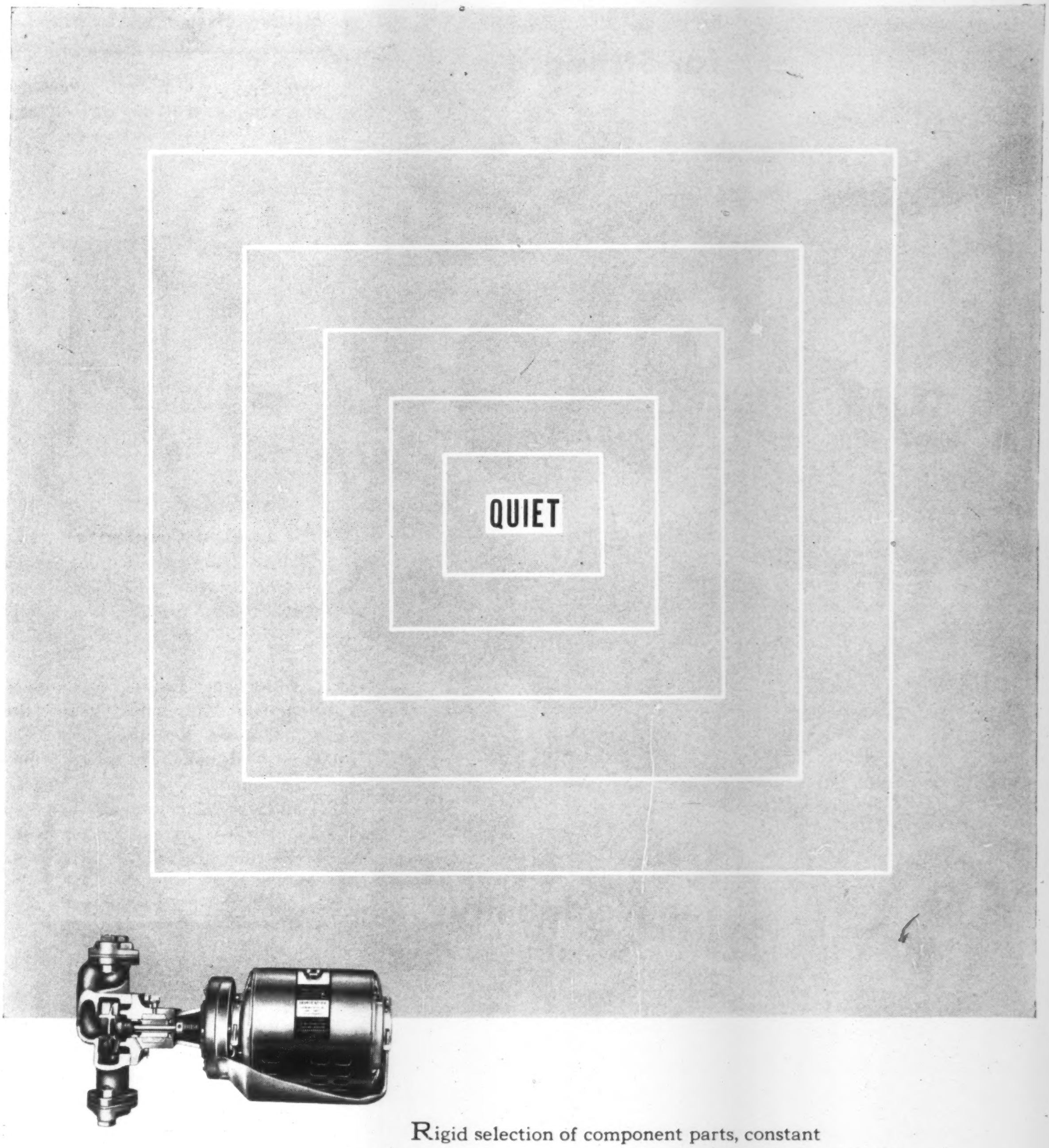
. . . featuring minimum floor space requirement, new v-belt drive arrangement designed for maximum accessibility—*American Blower Div. of American Standard, Dept. HPAC, Detroit* 32.

Packaged centrifugal type unit's construction provides nonoverloading wheel, welded steel construction, adjustable discharge, adjustable motor base, says company. V-belt drive arrangement is an overhung design, said to make it readily accessible for inspection, maintenance. "HS" sets available in 12 sizes with motors ¼ to 10 hp.

Power Pack . . .

. . . attachment for company's 500 ampere combination a-c/d-c "Idealarc" welder—*Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland* 17.

Designed to permit use of welder as power source for "ML-2" semiautomatic submerged arc welder. Combination intended to make a package capable of manual welding



Rigid selection of component parts, constant performance checks through a program of statistical quality control and thorough laboratory and field testing are but three of many steps TACO takes to assure you of a quiet circulator (regardless of size) on every installation.

And, Taco circulators are backed by a complete product line, national service and distribution facilities and 40 years of product pioneering.

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1160 CRANSTON STREET, CRANSTON, R. I.

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for Strength

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Hot formed steel is not subject to weld cracking, a chronic complaint on cold rolled products.

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All Thredolet fittings are heat treated after forging in accordance with A.S.T.M. A105.

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All Bonney fittings stay new and ready-to-use years after leaving our factory. Threads do not get clogged with grit as do oil-preserved fittings.

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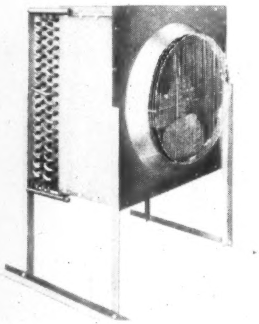
ALLOY
for all services

consider these features then specify and use BONNEY Thredolets and Sockolets for all small branch connections . . . and Weldolets for all large branch connections.

PENNSYLVANIA DIVISION
BONNEY FORGE & TOOL WORKS
Dept. C
ALLENTOWN, PENNSYLVANIA

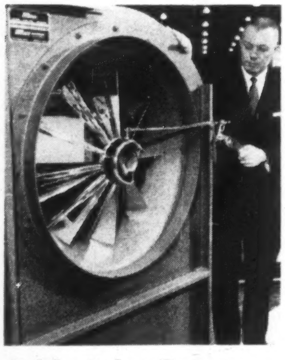
with d-c or a-c current, submerged arc welding with d-c current, says company. Power pack mounts directly onto welder.



Air Cooled Condenser . . .

. . . with balanced circuiting system said to increase efficiency of condenser coil—*Recold Corp., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles* 22.

Other cited features of "Dricon" unit are: adjustable angle iron stand; large, slow speed, belt driven fans; galvanized housing; copper tube, aluminum fin coils; strong fan guard; precision ground shaft; self aligning ball bearings; motor located inside unit for weather protection.



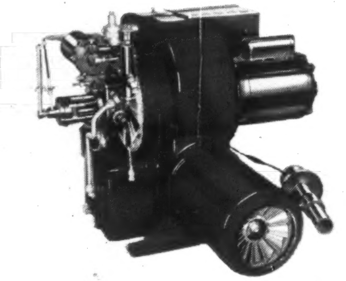
Variable Inlet Damper . . .

. . . for controlling air volume, pressure of airfoil centrifugal fans—*Chicago Blower Corp., Dept. HPAC, 9863 Pacific Ave., Franklin Park, Ill.*

Engineered to fit into fan housing, damper is said to provide maximum economy of operation by acting as

Believe us! We *know* why Cadillac once published an advertisement titled,

"The penalty of Leadership"



No leader can escape the attention of imitators! There's proof of this rule in Cleaver-Brooks' HEV-E-OIL—*today's most-copied heavy oil burner*

As stated in the Cadillac advertisement many long years ago, "In every field of human endeavor, he that is first must perpetually live in the white light of publicity. Whether the leadership be vested in a man or in a manufactured product, emulation and envy are ever at work."

The Hev-E-Oil burner was a standout from the start and continuing research and design refinement further extended initial leadership. Hev-E-Oil features were imitated, of course — not in their entirety but in adaptations and "pick-ups" appearing on a variety of heavy-oil burner designs.

"Jealousy does not protrude its forked tongue at the artist who produces a commonplace painting . . . The leader is assailed because he is a leader, and the effort to equal him is merely added proof of that leadership."

When introduced eighteen years ago, the Hev-E-Oil burner was (and still is) the first and only burner *successfully* applying the principle of low pressure air atomization of heavy fuel oils *inside the burner nozzle*. At last — a burner that could properly use low-cost, high-heat-content heavy fuel oils, such as No. 5. The early and immediate success of Hev-E-Oil naturally was followed by the usual imitators—competition scrambling to find "something just as good."

"If the leader truly leads, he remains — the leader . . . That which deserves to live — lives.

Consider these Hev-E-Oil exclusives:

- — true air atomizing, with the oil atomized inside the burner nozzle by low pressure air.
- — all air for combustion furnished by the burner independent of natural draft.
- — starting delayed until oil temperature is correct for electric ignition.
- — automatic pressure lubrication with *lubricating oil*.
- — the only line of combination oil and gas burners burning either fuel at maximum efficiency.

These are the Hev-E-Oil burner features that make it so modern it'll be new and unequalled for years to come.

Write Today for Complete Information

CLEAVER-BROOKS COMPANY, BURNER DIVISION, Dept. G, 392 East Keefe Avenue, Milwaukee 12, Wisconsin

Cleaver Brooks

HEV-E-OIL BURNERS – 27 MODELS – 5 GPH TO 90 GPH CAPACITY – INCLUDING COMBINATION HEAVY OIL AND GAS OR, LIGHT OIL AND GAS FIRED MODELS.

Pay Less
for metering chilled water lines

Builders low-head-loss Insert Flow Nozzle — installed between flanges in your chilled water lines — assures high-accuracy indication of flow and at the same time keeps meter head loss to a minimum. For air conditioning systems in commercial buildings, shopping centers, and similar multiple-occupant facilities, this hydraulically tested and proven flow nozzle gives the flow facts you need to maintain peak system efficiency.

HERE'S WHY THIS FLOW NOZZLE IS WIDELY ACCEPTED:

Pressure/Temperature Proof: Insert design withstands same pressures and thermal shocks as pipe itself.

Enduring Accuracy: Precision machining throughout bronze throat liner and contoured inlet. Perpendicularly drilled and reamed piezometer taps.

±1%

Low Head Loss: Efficient Venturi outlet cone assures high pressure-head recovery — permits use of smaller pumps, motors, piping.

Easy Installation: Pressure taps are built-in . . . no special measurements or machining required in field.

Multiple Throat Vents: For accurate metering even with upstream flow disturbances.

Bulletin 130-K3A gives complete dimension, capacity, and installation data. Write for your copy to **BUILDERS-PROVIDENCE, INC., 381 Harris Ave., Providence 1, R. I.**

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DIVISION OF
B-I-F INDUSTRIES
METERS FEEDERS CONTROLS

EQUIPMENT DEVELOPMENTS

Continued

manual or automatic output control. Features nine pie-shaped metal vanes, mounted in aerodynamic inlet cone and adjustable at angles zero to 90 deg. Set at desired pitch, metal vanes spin entering air in direction of fan blade's rotation. Unit permits easy opening and closing of vanes, eliminates binding problems, says company.

Offset Rolls . . .

. . . for joining round, heavy gage elbows and pipe sections—*Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo 11, N.Y.*

Are said to reduce joining time by 50 percent. Of hardened polished steel, are available for both hand, power models of company's combination rotary machines. Recommended by manufacturer to speed installation of industrial blower, exhaust systems. Are said to permit continuous forming of offset flanges to varying angles required, for mating elbow segments, without removing work from machine.

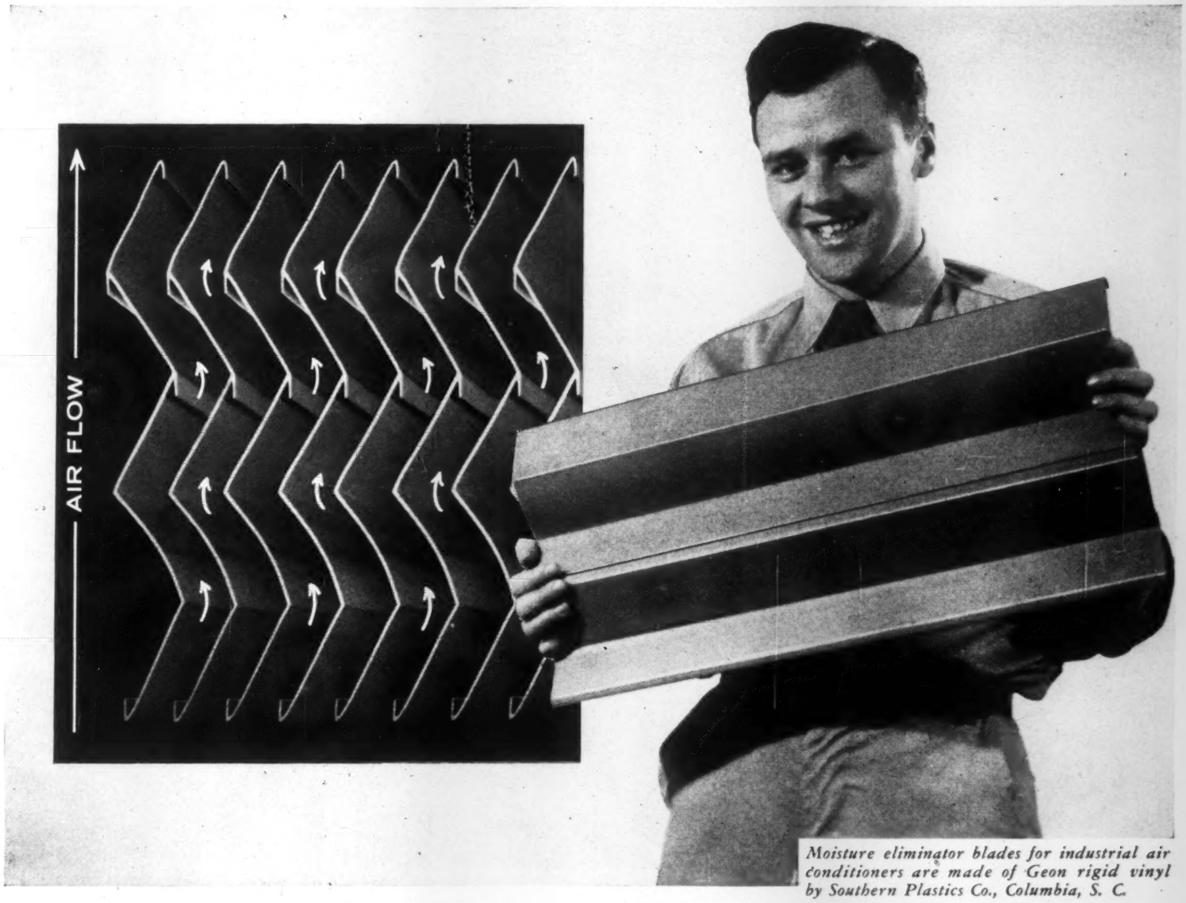
Plastic Pipe . . .

. . . of polyethylene resin—*Orangeburg Mfg. Co., Inc., Dept. HPAC, Orangeburg, N.J.*

"SP" pipe is said to have increased working pressures and heat resistance, absence of stress cracking, and resistance to chemicals, organic solvents and hydrocarbon liquids. Available in $1/2$ to 2 in. sizes. In coil lengths to 400 ft.

Another new development using

B.F.Goodrich Chemical *raw materials*



Moisture eliminator blades for industrial air conditioners are made of Geon rigid vinyl by Southern Plastics Co., Columbia, S. C.

blades of Geon keep air dry...end replacement problems

THESE moisture eliminator blades for industrial air conditioners are now made of Geon rigid polyvinyl chloride compound — to end frequent replacement of formed sheet metal blades.

Parts made of Geon rigid vinyl won't corrode. They are economical, easy to clean and extremely durable... meet flameproof requirements. Air-carried corrosive materials have no destructive effects on these blades because Geon has exceptional resistance to acids, alkalies and other chemicals.

Geon polyvinyl resins and plastics are unique raw materials. Their outstanding physical, chemical and electrical properties have opened markets for many new products—rigid piping, wire insulation, flexible wall covering, foam padding, coatings for textiles, metal and paper.

For further information on Geon write Dept. FL-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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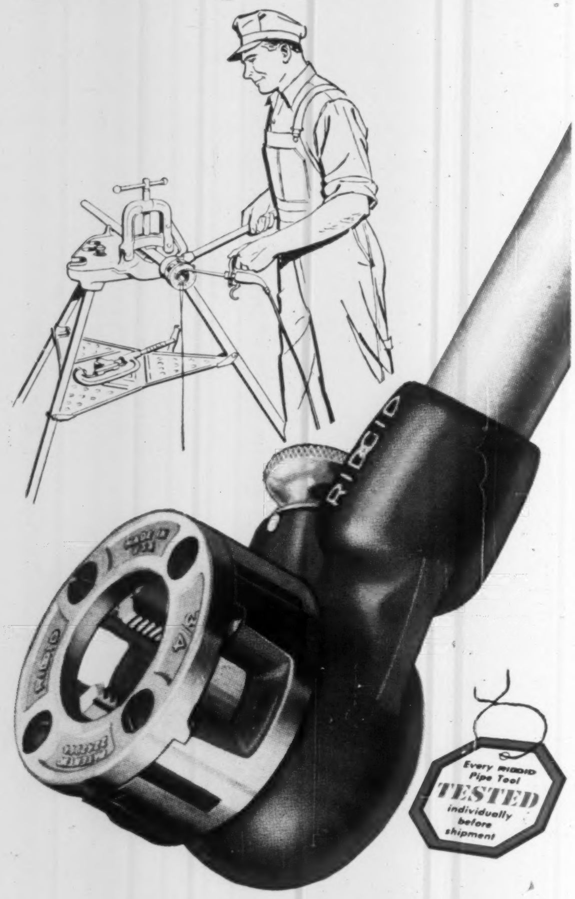
B.F.Goodrich **GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors**

...No Equal for Quick Pipe Threading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Every RIDGID Pipe Tool TESTED individually before shipment

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RIDGID Drop-Head Dies

A die head for each size, ⅛" to 2"—they snap into ratchet ring from either side, can't fall out—reverse for close threads. Tough malleable and steel heads, famous RIDGID long-wear dies—conduit or special dies available. OOR and OR, ⅛" to 1"; 111R and 11R, ⅛" to 1¼"; 12R, ⅛" to 2". Bargains in fast easy threading—at your Supply House.

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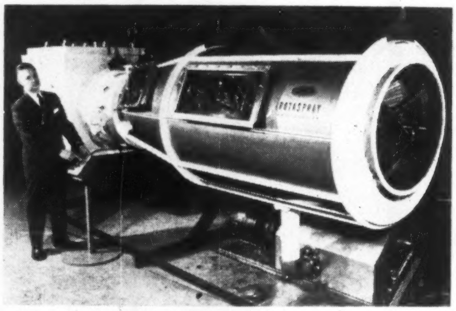
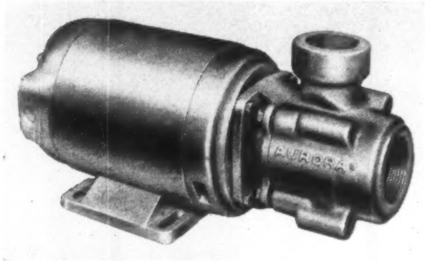
RIDGID Work-Saver Pipe Tools



Air Conditioning System . . .

. . .for large industrial areas—*Carrier Corp., Dept. HPAC, Syracuse* 1, *N.Y.*

Cited feature is new spray type air conditioning unit. Central conditioner takes only one-third space of present equipment, says company. Is said to provide more accurate control of humidity, "virtually eliminate" system cleaning and maintenance. "Rotaspray Weathermaker" engineered for overhead installation. Designed to handle greater volume of air at higher velocities. Especially recommended by manufacturer for textile mills. In four sizes with capacities 10,000 to 30,000 cfm of conditioned air.



Close Coupled Pumps . . . .

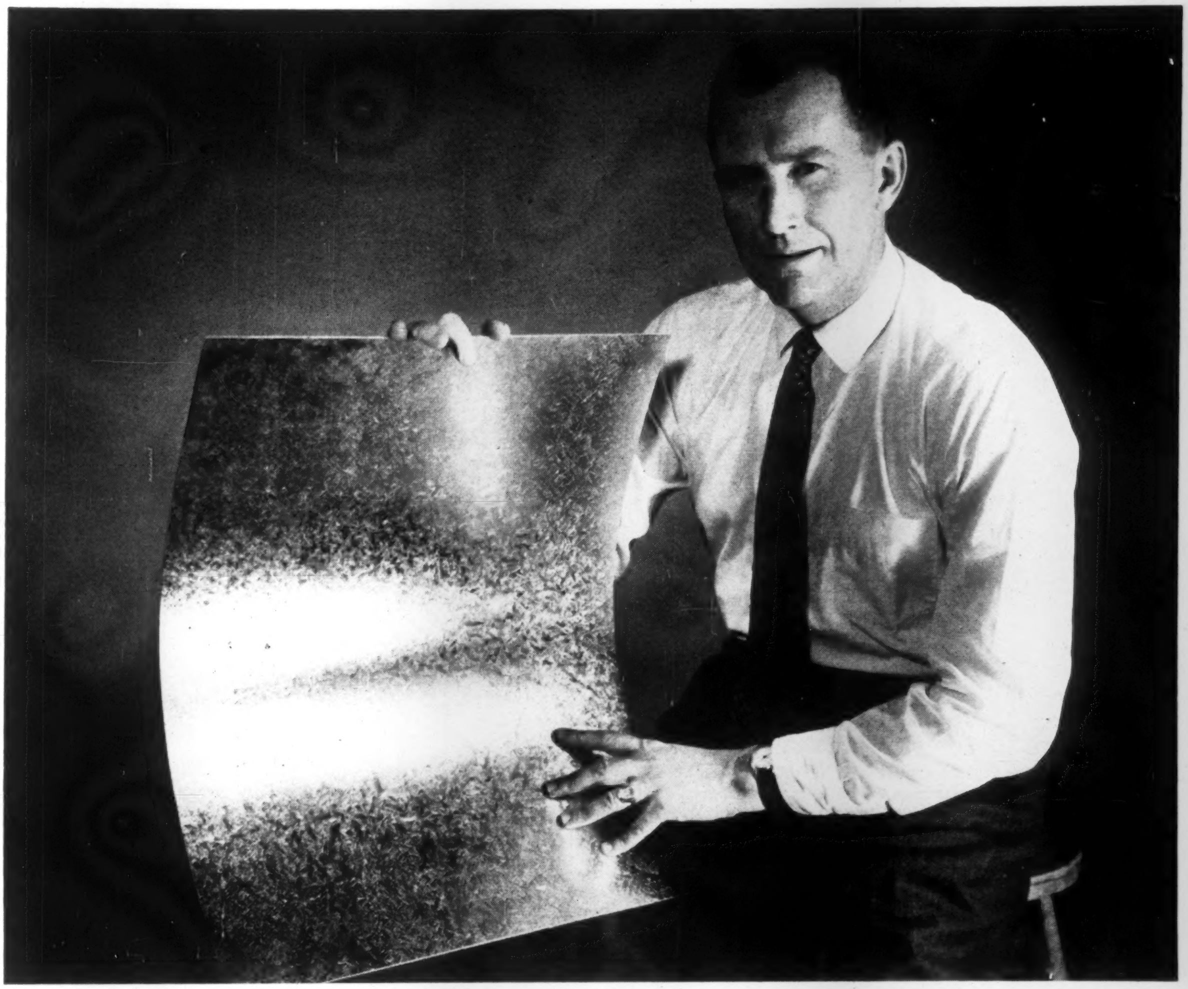
. . .in 21 sizes, 1/6 to 5 hp, with capacities to 150 gpm and heads to 140 ft—*Aurora Pump Div., New York Air Brake Co., Dept. HPAC,* 80 *Loucks St., Aurora, Ill.*

Operate at 3500 rpm, single- and three-phase. Designed to meet critical suction conditions, units are said to have low NPSH characteristics. Recommended by company for air conditioning applications, cooling towers, evaporator coolers, hot water circulators, general service.

Welding Process . . .

. . .designed to produce faster, better welding at lower cost—*National Cylinder Gas Co., Dept. HPAC,* 840 *N. Michigan Ave., Chicago* 11.

"Dual Shield" process is said to deposit weld metal faster than other methods. Uses flux-core electrode in economical, effective combination with shielding car-



Bethcon: not too soft, not too stiff

Next time you get a piece of galvanized sheet in your hands, flex it back and forth a few times to get the "feel" of it. If that piece of steel just happens to be Bethcon, we'll bet it feels just right. Not limp and lifeless, not stiff as a board, but full of life and workability.

Translate that into terms of shopwork and finished product. It means that Bethcon will form up readily on your brakes and lock-formers. And it also means that the completed ductwork will be strong and rigid, ready for many long years of trouble-free service.

There is, of course, a very sound reason for Bethcon's ideal qualities. Our continuous galvanizing lines at Sparrows Point, Maryland, are of the very latest design, and include a continuous annealing process which gives the sheet just the right blending of strength and ductility.

Continuous galvanizing also bonds the zinc to the base metal much more tightly than conventional methods; so tightly, in fact, that the coating will not flake off even when the sheet is bent back on itself. It also does away with the old familiar bead on the drip end of the sheet.

You can order Bethcon sheets in cut lengths or coils, 13-ga and lighter, in either plain open hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal, depending on your requirements. For further information, just get in touch with the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

19,862 years of experience

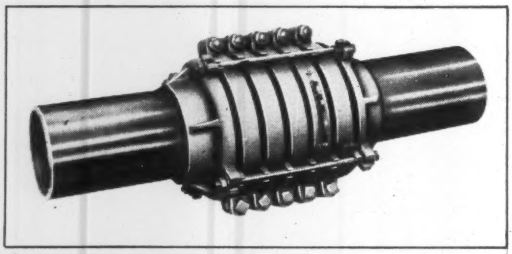
Every FLEXON® Expansion Joint is the product of unmatched skill in precision metal-forming

Experience and skill . . . the combined metal-forming experience of the team of engineers, metallurgists and skilled technicians who produce FLEXON Expansion Joints totals 19,862 years!

Years of forming and corrugating tubular shapes in metal—flexible metal hose, instrument-type bellows, "impossible" bends and section modulations for aircraft . . . and expansion joints of every kind.

Your dividend of this unequalled experience is expansion joints that you *install and forget.* Free-flexing and controlled-flexing; dual and multiple types; balanced joints and other special designs; all in stainless steel, monel, and other workable alloys. Assured longer service life, through careful analysis of your application, plus skillful manufacture.

Write today for your copy of the Flexon Expansion Joint Design Guide—28 pages of facts about absorbing pipe motion.



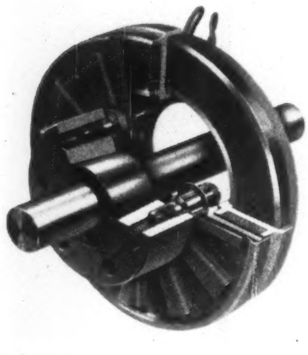
EJ-200

Flexonics
corporation

EXPANSION JOINT DIVISION—1391 S. THIRD AVE., MAYWOOD, ILL.

EXPANSION JOINTS · METAL HOSE · NON-METALLIC HOSE · BELLOWS · AIRCRAFT COMPONENTS

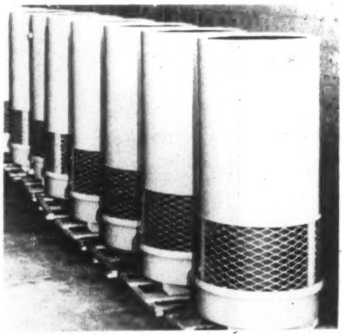
bon dioxide gas, says company. Recommended by manufacturer for welding any type of mild steel.



Brakes . . .

. . .engineered to combine high torque and fast cycling with ability to hold or stop load if power fails—*Warner Electric Brake & Clutch Co., Dept. HPAC, Beloit, Wis.*

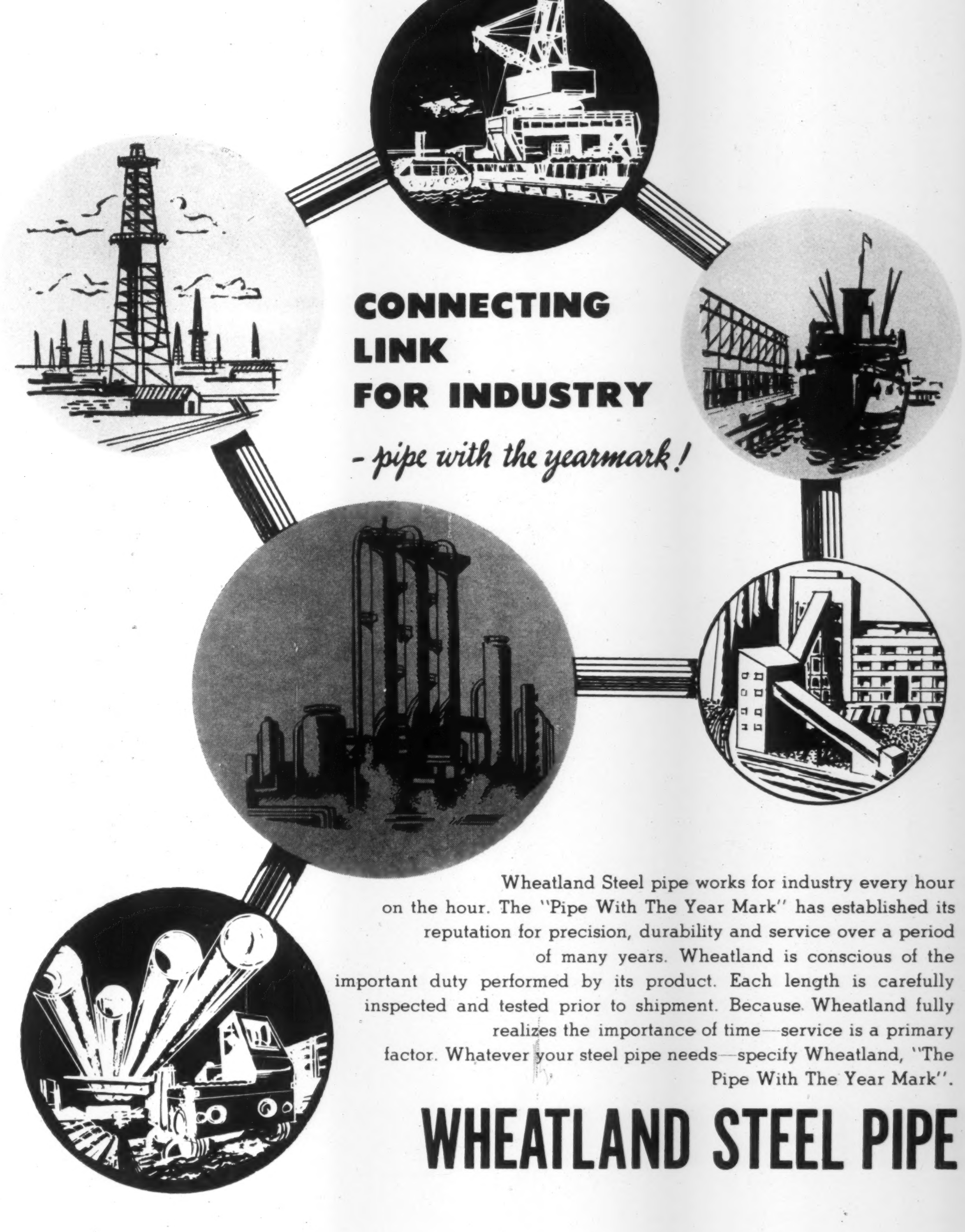
Four basic sizes currently listed. Power torque ratings range 125 to 650 lb ft, "fail-safe" torque ratings are 33 to 205 lb ft. Models also available that provide fail-safe feature with electrical release but without power braking.



Cooling Tower . . .

. . .designed to use jet action to force air through tower—*Koch Engineering Co., Inc., Dept. HPAC, 321 W. Douglas, Wichita 2, Kan.*

Construction of "Jet Action" eliminates fans, electric motors, belts, pulleys, bearings, says company. Air movement, cooling accomplished by system of water jet nozzles at top of tower.



CONNECTING LINK FOR INDUSTRY

- pipe with the yearmark!

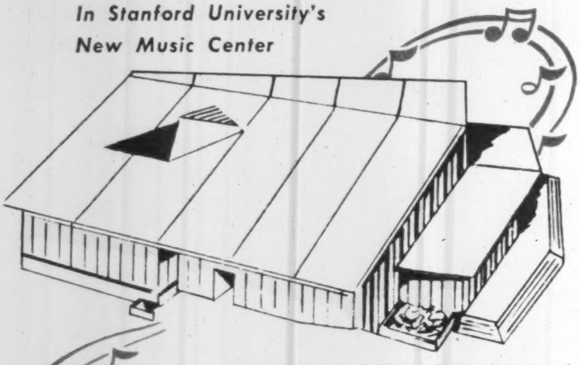
Wheatland Steel pipe works for industry every hour on the hour. The "Pipe With The Year Mark" has established its reputation for precision, durability and service over a period of many years. Wheatland is conscious of the important duty performed by its product. Each length is carefully inspected and tested prior to shipment. Because Wheatland fully realizes the importance of time—service is a primary factor. Whatever your steel pipe needs—specify Wheatland, "The Pipe With The Year Mark".

WHEATLAND STEEL PIPE

WHEATLAND TUBE COMPANY

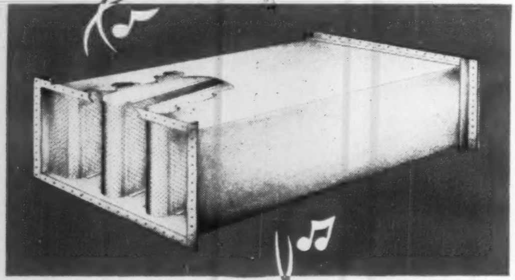
BANKERS SECURITIES BLDG., PHILA. 7, PA. MILLS • WHEATLAND, PA. • DELAIR, N. J.

In Stanford University's
New Music Center



Architects—Milton T. Pflueger, Eldridge T. Spencere & William Clement Ambrose
Consulting Engineers—Buonaccorsi & Murray
Mechanical Contractor—James A. Nelson Company

only the music shall be heard!



thanks to

IAC Your Standard of Silence

Quiet Duct

packaged standardized silencing

The air-conditioning and ventilating system of Stanford University's new Music Center was silenced *in the design stage* with *rated* IAC Quiet-DUCTS!

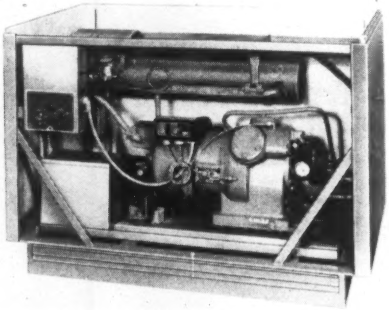
Pre-fabricated in as many as 148 sizes, these economical Quiet-DUCT units measuring in length from 2 to 10 feet, provide as much noise control as a conventional lined duct measuring from 30 to 100 feet long!

COMPLETE DATA AVAILABLE

Write today for a complete set of data sheets and catalog describing prefabricated "Quiet-DUCT" units.

Industrial Acoustics Company, Inc.

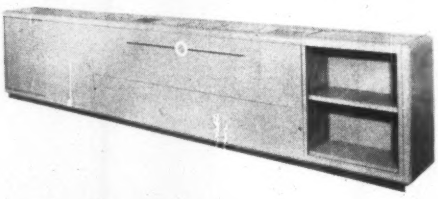
Specialists in Noise & Pulsation Control
341 Jackson Avenue, New York 54, N. Y. CYpress 2-0180



Packaged Water Chiller . . .

. . . in 3, 4 hp sizes—*Worthington Corp., Dept. HPAC, Harrison, N.J.*

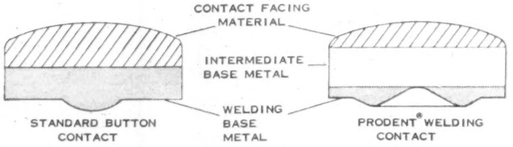
Requires no field refrigerant piping. Designed to meet commercial, industrial requirements. Consists of water chiller, compressor, water cooled condenser, controls—all factory assembled in insulated, bonderized steel cabinet requiring only 8.3 ft floor space, says company. Equipped with automatic controls including on-off switch, thermometer, freezeup thermostat set at 38 F, magnetic starter that controls compressor operation.



Classroom Air Conditioner . . .

. . . in new 1957 model—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

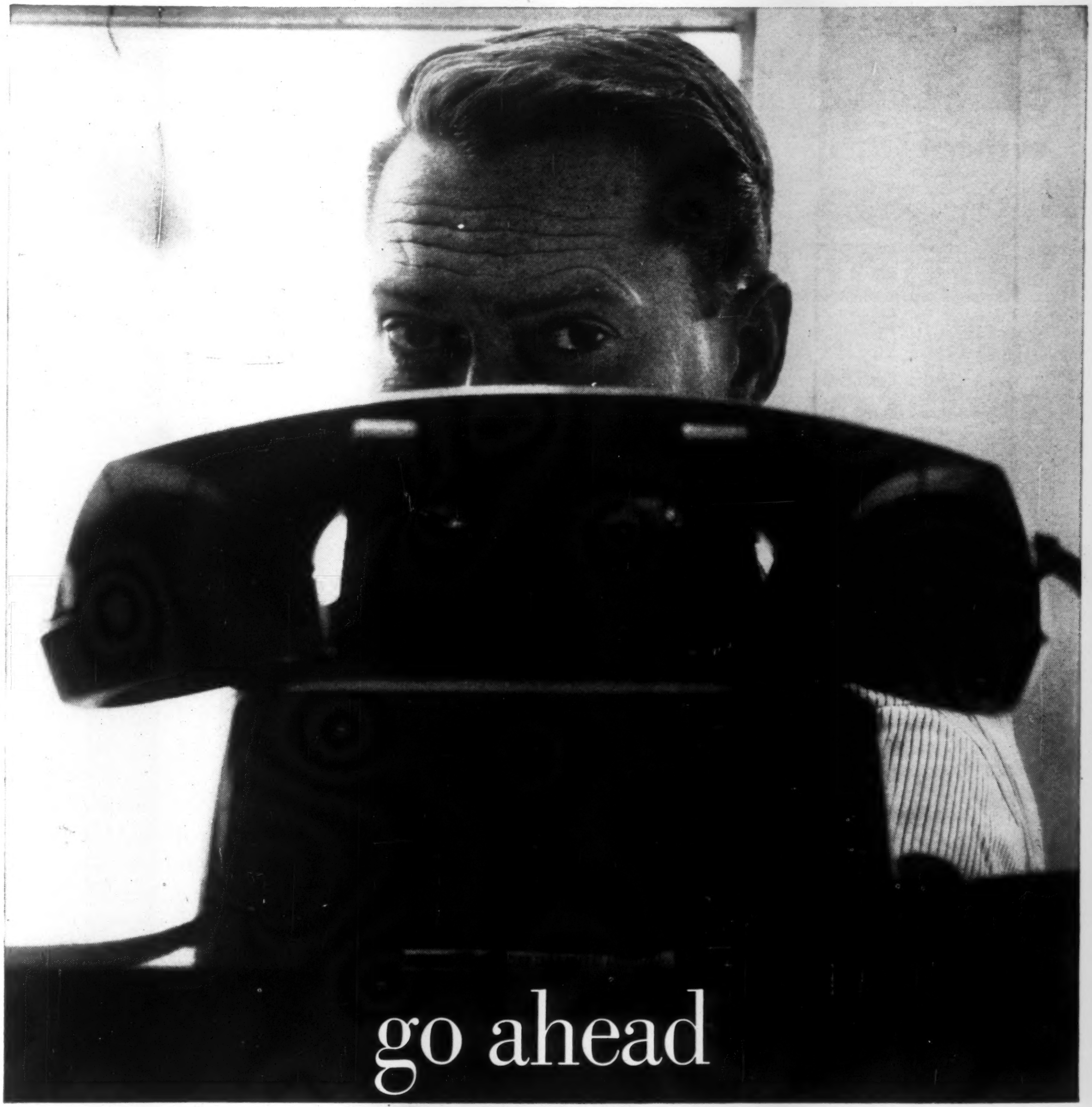
"HerNel-Cool II" year 'round unit ventilator for schools has following cited features: "draft/stop" system of controlling window downdrafts in wintertime; new cleanable "drain collector" beneath piping connections to collect condensate; larger end panels for accessibility for servicing; modulating bypass damper control.



PROJECTION WELDING CONTACTS OF TRIMETAL CONSTRUCTION

Welding Contacts . . .

. . . in wide range of sizes—*General Plate Div., Metals & Controls Corp., Dept. HPAC, Attleboro, Mass.*



go ahead

CALL!

the fastest cure for worry about cancer: a call to your doctor now!

Scared? You shouldn't be! Look at it this way. The average man who walks into the doctor's office walks out floating. That lump that was so frightening . . . nothing to worry about at all! The sky's bluer, the air's sweeter, it's a great big beautiful day . . . because he picked up that phone and called!

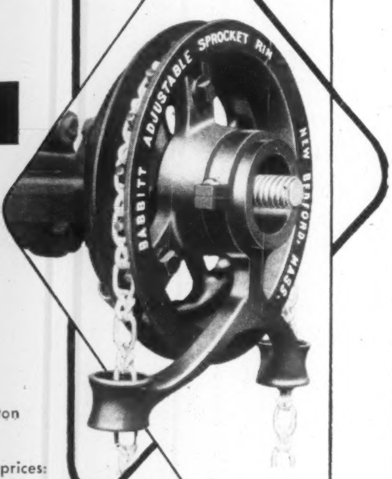
It happens all the time. It can happen to *you.* "Sure," you say, "but just supposing"... OK. Let's look at the facts. In past years, we were saving 1 out of 4 cancer patients. Today, we're saving 1 in 3. And the odds could get better still . . . if *people would call their doctors in time!*

So go ahead...call. See your doctor now. And after your checkup—how about a check for the American Cancer Society? Every dollar sends us further along the road to cure. And when *that* happens . . . it's going to be a wonderful day for us all! Send your check to "Cancer" in care of your local Post Office.

REACH All
Overhead Valves without DANGER!
REACH for

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide



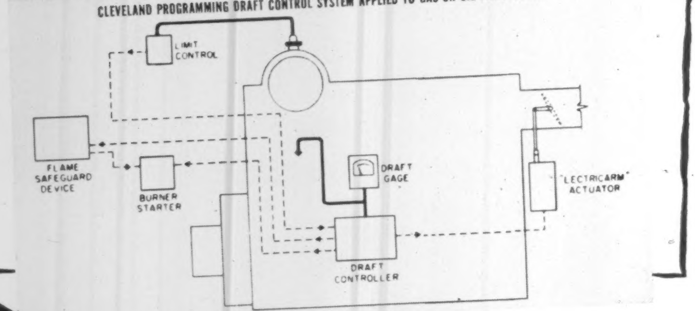
- Eliminate dangerous catwalks, ladders, balconies, boxes, stools, etc.
- Prevent accidents, protect personnel
- Reach inaccessible areas easily
- Operate every valve from plant floor
- Easy to install and operate
- No maintenance; first cost, *only* cost
- Easy instructions with each unit
- Packed, completely assembled, one to a carton
- Fits any size valve wheel
- Your supplier carries complete stock
- Write for new descriptive Catalog sheet and prices:

Babbitt STEAM SPECIALTY CO.
8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

Free DATA ON COMBUSTION AUTOMATION SYSTEM

CONTROLS NO. 2 OF A SERIES

CLEVELAND PROGRAMMING DRAFT CONTROL SYSTEM APPLIED TO GAS OR OIL FIRED BOILER



WRITE TODAY
for FREE Manual (No. 2) plus "Control Fundamentals" booklet.

HOW TO PLAN AND SPECIFY THE CONTROL SYSTEM BEST FOR YOU

Schematically diagrammed and easy to understand, this FREE Manual is No. 2 of a series designed to enable you to solve your combustion control problems. Tells how to select the proper controls to automatically maintain top combustion efficiency and safety under all firing and load conditions.

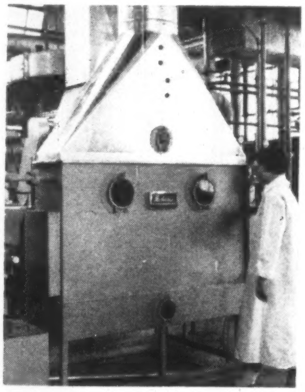
CLEVELAND CONTROLS
1111 Brookpark Rd. • Cleveland 9, Ohio
"100 Field Engineers To Serve You"

COMBUSTION CONTROL SYSTEMS
INDICATING INSTRUMENTS
AIR SAFETY SWITCHES
PANEL CONTROL CABINETS

EQUIPMENT DEVELOPMENTS

Continued

"Prodent" contacts are said to decrease welding flash blowouts, improve thermal and electrical conductivity, increase effective weld areas as result of configuration, eliminate mushrooming by promoting flat seating and parallel welding. Recommended by company for welding to thin springs, thin mounting supports. Available with facings of silver alloys, silver-cadmium oxides, precious and noble metals and their alloys, sintered metal compositions.



Humidity Control Unit . . .

. . . engineered for control of humidity applications such as processing, storage, drying, condensation, testing, comfort—*Air Conditioning and Drying Div., Surface Combustion Corp., Dept. HPAC, Toledo* 1.

Nickel construction on regenerator is said to eliminate corrosion problems. Porthole type, glass inspection doors provide internal visibility, permit quick, easy accessibility to sumps, eliminator chambers, fan chambers, etc., says company.

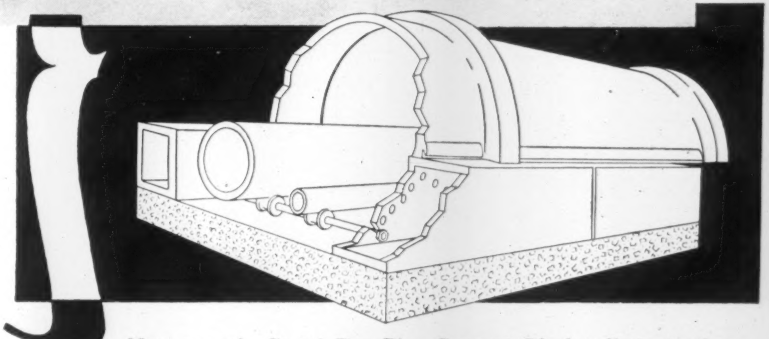
Vertical Pumps . . .

. . . engineered for circulating hot or cold water, condenser water and for booster pump service—*Weil Pump Co., Dept. HPAC,* 1530 *N. Fremont St., Chicago* 22.

"VKY" unit, with one shaft seal (mechanical), has following features usually found only in horizontally split case design, says company: re-

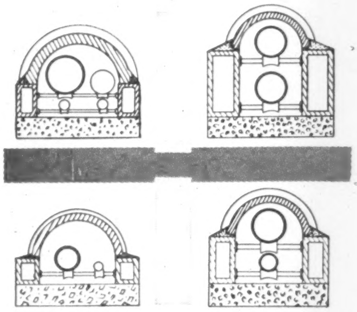
PERMANENT PROTECTION
for underground piping!

STILLWATER CERT-A-BAR* TUNNEL CONDUIT SYSTEM



New ceramic Cert-A-Bar Pipe Support Blocks eliminate the need for interior cast iron rests. The perforated block is laid as a structural support member at regular intervals, and the bars are simply inserted and locked in place.

THE vital consideration in selecting an underground conduit system is *permanent* protection . . . not for one year or five, *but for the life of the piping.* You get the best possible protection for your underground metal service piping with a Stillwater Conduit System of vitrified clay. It's chemically inert—can't rust, rot, corrode, or decay . . . ever. And it is manufactured in accordance with ASTM specification C-13-54, assuring proper strength and quality. Any combination of service piping can be protected. Conduit is available in a wide range of sizes, with a complete line of fittings and accessories, including alignment guides, lateral guides, and anchors. Any contractor's crew can handle the installation easily, or if you prefer, Stillwater Licensed Installers will assume the responsibility. The Cert-A-Bar Tunnel System can be installed with any of three suggested new waterproofing specifications—one for average conditions, one for intermittent ground water conditions, and a third for high water table conditions. It's the lowest-cost conduit per year of service that you can specify or install!



THE CERT-A-BAR SYSTEM HAS ALL THESE IMPORTANT ADVANTAGES

- Inherent structural strength for permanent protection
- Complete flexibility for design
- Minimum initial and long-term costs
- Quickly installed
- Keeps pipe insulation dry
- No electrolytic corrosion of piping
- No maintenance required

A few of the hundreds of possible combinations of piping for the Cert-A-Bar Tunnel System are shown at left.

WRITE FOR

illustrated, four-page circular with complete installation specifications.

*T.M. Reg. App. For.
Patents Pending

The Stillwater Clay Products Co.
STILLWATER CONDUIT DIVISION
3334C Prospect Avenue, Cleveland 15, Ohio

STILLWATER
CONDUIT
SYSTEMS

GREEN Sure Seal* air filter

FILTER MEDIA ROLL DOWN DOESN'T BREAK SEAL

It doesn't help very much when a shot of contaminated air sneaks around the seal when an air filter automatically changes plugged media to fresh media. The unit should be kept sealed at *all* times.

With the GREEN *Sure Seal* AIR FILTER, a floating tubular frame seals the media against the panel frame *at all times*, even when the media is being rolled down to provide fresh cloth . . . indexing, as we call it.

Perhaps this is the most important factor for you to consider in your plans for an air filter. If you need filtered air you need it *all* the time. You just can't allow the unit to be "off duty" while indexing.

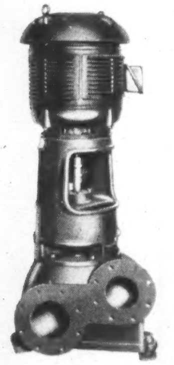
We suggest you look into the merits of the GREEN *Sure Seal* AIR FILTER for your clean air requirement.

Send for
BULLETIN 175
All the details including capacity and dimensional data are given.

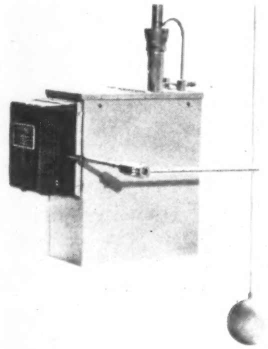
*U.S. Patents Pending

You can have confidence in the Green Line of products— which have been world-wide since 1845.

THE GREEN
POWER AND PROCESS PLANT EQUIPMENT
FUEL ECONOMIZER COMPANY INC.
BEACON 3, NEW YORK
Representative in Principal Cities



quires only 25 percent of floor space of same size horizontally mounted pump; supply and discharge piping are on one side, all operating parts can be removed without disturbing piping connections; motor mounted to prevent misalignment; three rubber vibration eliminator units. Pumps available in 2, 3, 4, 5 in. discharges.

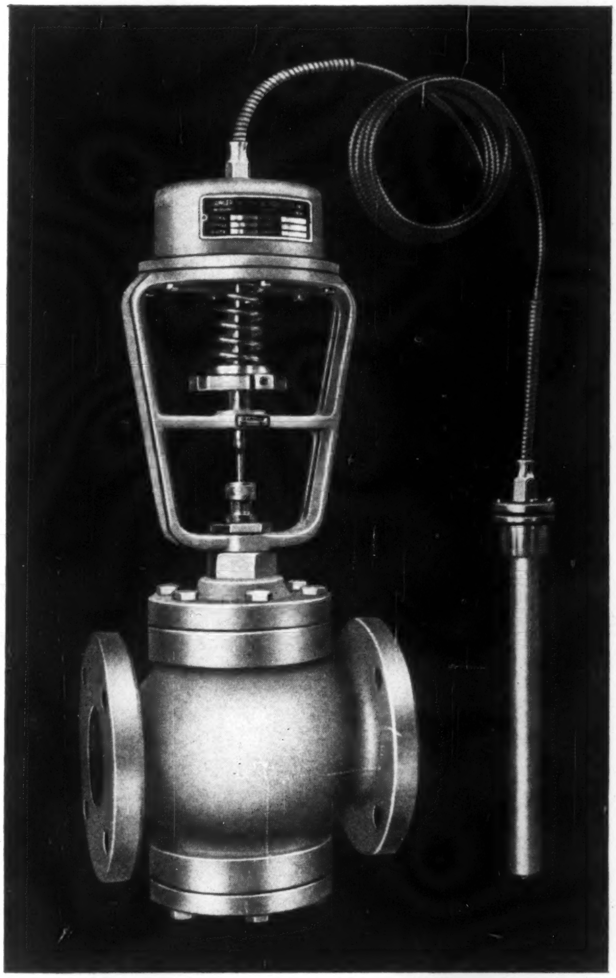


Control . . .

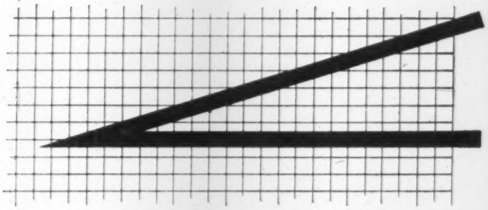
. . . designed as automatic water treatment feeder and bleed-off regulator for control of mineral scale, slime, algae in cooling water used for air conditioning, refrigeration—*Heller Laboratories, Inc., Dept. HPAC*, 124 *Fort Lee Rd., Leonia, N.J.*

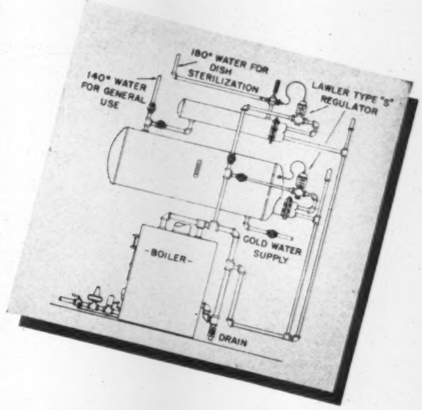
"Hydrotrol" regulates water treatment according to amount of water evaporated from cooling water system instead of by constant volume chemical feed and bleed-off methods, says company. Is said to facilitate regulation of cooling water treatment without continual water analyses, adjustments, close supervision.

INSTANT PROTECTION...



PRECISION CONTROL!




180° WATER FOR DISH STERILIZATION
140° WATER FOR GENERAL USE
LAWLER TYPE "S" REGULATOR
-BOILER-
COLD WATER SUPPLY
DRAIN

LAWLER TYPE "S" TEMPERATURE REGULATOR

DIRECT ACTING — Accurately controls all steam heating equipment. Protects against over heating . . . a rise in temperature above setting closes valve.

REVERSE ACTING — For cooling systems and recirculating lines. Rising temperature opens valve . . . drop in temperature causes valve to close.

THREE WAY — Mixes hot and cold liquids . . . delivers them at a constant pre-determined temperature.

ONE DEGREE OFF — up or down, and the Lawler Type "S" Temperature Regulator is in action . . . correcting to and maintaining the desired temperature.

Hydraulically formed bellows are non-ferrous, give "hair-line" control with instant response. Highly polished stainless steel valve stem provides friction-free operation for real rugged performance . . . longer lasting durability.

There's no job too tough . . . too unique for the Type "S". It's available in many variations for any special purpose. In industry, dairies, food processing, Diesel engineering . . . where ever steam, gases or fluids are used, the Lawler Type "S" Temperature Regulator will do an excellent control job for your customer.

THE Lawler

PERFORMANCE TESTED FOR LONGER LIFE

Steam Temperature Regulators
Thermostatic Shower Mixing Valves
Water Controllers
Tempering Valves

DESIGNERS AND PRODUCERS OF THERMOSTATICALLY OPERATED VALVES SINCE 1895

Line of Thermostatic Control Valves

LAWLER AUTOMATIC CONTROLS, INC., MT. VERNON, N. Y.

Magnificent

any way you look at it!

Modine Gas Unit Heaters are years ahead in styling

Here's superb styling, sturdy construction, unbeatable performance. Stainless steel burners and stainless or aluminized steel heat exchangers and direct-fired tubes assure quick heat . . . long-lasting, economical service. And Modines are up to 50% lighter, cost less to ship and install. Eight sizes are available from 25,000 to 310,000 Btu. For natural, mixed, LP and LP-air gas mixtures.

Modine is years ahead in long-life efficiency

FAST, UNIFORM HEAT

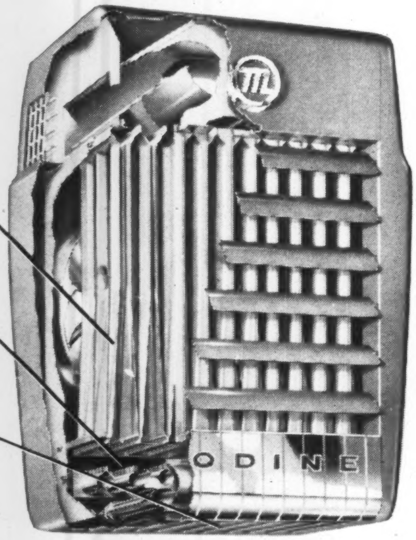
Direct-firing of each heat exchanger tube assures quick, uniform heat distribution.

TROUBLE-FREE OPERATION

Large, knife-sharp stainless steel ports resist lodging of dirt and scale.

IMPROVED COMBUSTION

Hooded combustion air inlets below each burner tube improve efficiency . . . minimize flame disturbance.



Complete details are contained in Bulletin 656-A. Get your copy by calling the Modine representative listed in your classified phone book or use the handy coupon.

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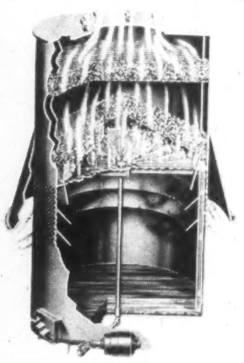
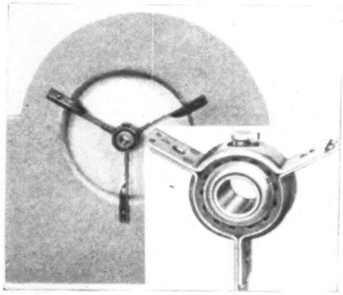
GU-1345



Oil Bath Air Cleaner . . .

. . . with four major improvements—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

Cited features: redesigned base for easier, less expensive installation; improved protection at air intake against snow, water; increased bug protection; redesigned and improved "vari-flow" valves.



Ball Bearing Unit . . .

. . . with new "Tri-Arm" mounting—*Triangle Mfg. Co., Dept. HPAC, Oshkosh, Wis.*

Cited features of mounting: triple cantilever-beam action which unites, pyramids separate strengths of housing and bracket; multiribbed cushion engineered to perform several services simultaneously. "Hiawatha" unit recommended by company for heating, air conditioning industry.

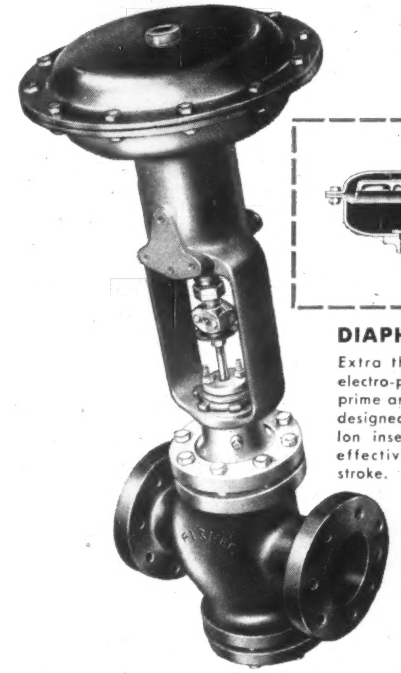
Fans . . .

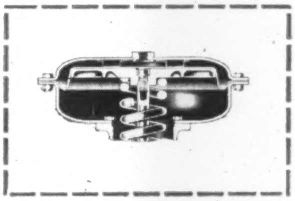
. . . engineered for efficient performance against static pressures normal-

Any Way You Look At It

FISHER® Control Valves

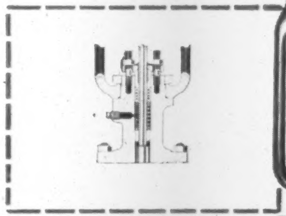
are your BEST BET!

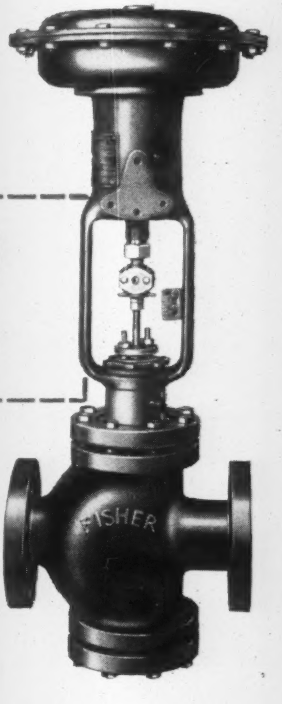




DIAPHRAGM ASSEMBLIES

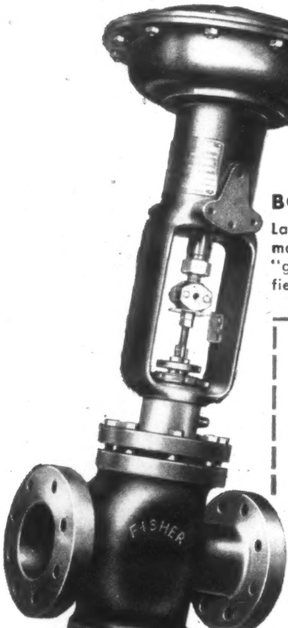
Extra thick steel casings are zinc electro-plated, iridited and then given prime and final paint coats. Specially designed molded diaphragm with nylon insert gives practically constant effective area throughout valve stroke.





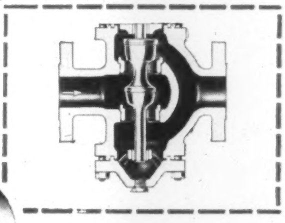
STUFFING BOX

Bolted gland stuffing box with Teflon V-Ring packing. Highly polished valve stem is finished to 2-3 micro-inches RMS to insure effectiveness of packing and keep friction to absolute minimum.



BODY ASSEMBLIES

Large capacity bodies with accurately machined inner valves are individually "ground in" under customer's specified temperature conditions.



Realizing their importance in the control system, Fisher has given careful attention to design and construction of diaphragm control valves. Any way you look at it — from the standpoint of durable construction or accuracy of performance—Fisher Diaphragm Control Valves are your best bet.

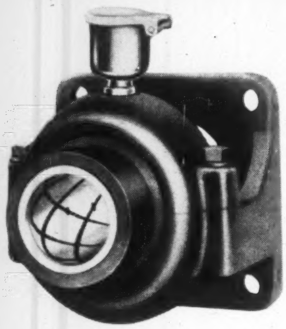
FISHER GOVERNOR COMPANY

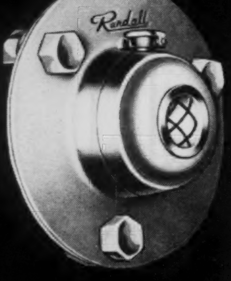
Marshalltown, Iowa • *Woodstock, Ontario*

World Leader in Research for Better Pressure and Liquid Level Control

Randall
FLANGE PILLOW BLOCKS

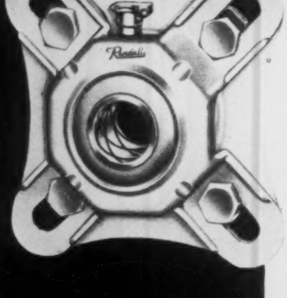
GREATER EFFICIENCY AND
ECONOMY IN EVERY
SIDE-MOUNTED APPLICATION
•
QUIET IN OPERATION
AUTOMATIC SELF-LUBRICATION
SELF-ALIGNMENT
LONG TROUBLE-FREE SERVICE





Like all Randall Pillow Blocks, these flange models incorporate Randall's "DEEP-WELL"® ball assemblies with a grooved and graphited cast-bronze bushing. The unique automatic double lubricating principle, coupled with Randall's exclusive graphite mixture, permits extended periods of operation without maintenance. Easier to install Randall Flange Pillow Blocks are available for most side-mounted applications for shaft sizes from ½" to 3$^{7}/_{16}$".

Randall—leading developer and manufacturer of the air-moving industry's most dependable bearings—supplies quality, efficient and low cost sleeve bearing pillow blocks for every application. Randall Pillow Blocks may be modified for unusual conditions and adapted to many different styles of lubrication. In smaller shaft sizes, Randall Pillow Blocks are available with sintered bronze bushings for light duty applications. Contact your nearby Randall distributor today. He's listed in the yellow pages of the telephone directory under "Bearings."



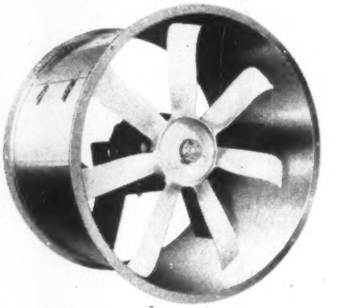
RG3

Randall

LOOK TO RANDALL FOR YOUR
SLEEVE BEARING REQUIREMENTS

Clip this coupon to your letterhead, include your name and department and send it to Randall Graphite Bearings, Inc. We will send you the complete Randall Pillow Block Catalog.

RANDALL GRAPHITE BEARINGS, INC.
1012 S. Greenlawn Avenue, Lima, Ohio



ly considered above range of propeller type fans—*Aerovent Fan Co., Inc., Dept. HPAC, Piqua, Ohio.*

"SP-7" units especially effective in medium pressure range to 4 in. SP, says company. Are said to move more air at slow speeds, with essentially lower hp requirements. Available in variety of models in sizes 14 to 60 in. diameter.

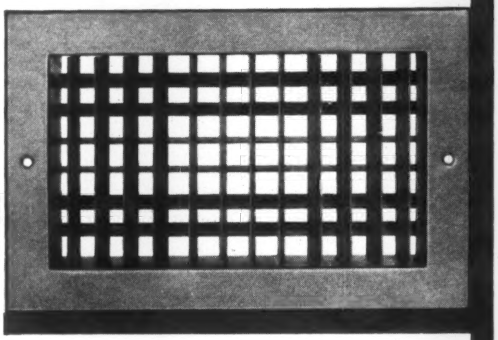
Air Cooled Conditioners . .
. . . in 10, 15 hp units added to manufacturer's packaged "Weathermaker" line—*Carrier Corp., Unitary Equipment Div., Dept. HPAC, Syracuse* 1, *N.Y.*

Cited feature of equipment is low friction compressor said to use less power at peak loads. Compressor and refrigeration motor lubricated, hermetically sealed to casing designed to keep out dust, dirt, moisture. Fan engineered to move large masses of air at low velocities. Cooling coil set at steep angle to expose maximum surface to air stream and to insure longer contact of air and cooling coil, says company. Units designed for central or direct air conditioning of stores, offices, shops, small industrial buildings.

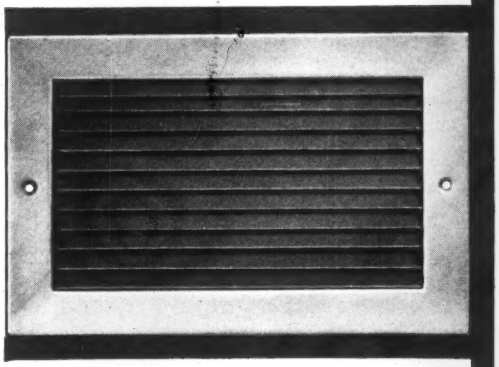
Press Brakes . . .
. . . with "Let-up Control" feature—*O'Neil-Irwin Mfg. Co., Dept. HPAC,* 541 *Eighth Ave., Lake City, Minn.*

Is said to eliminate whipping, resultant kinking of sheet metal during forming operations. Basic element in control is adjustable flow control valve. Long sheets can be handled safely and efficiently, says

What makes WATERLOO the buy-word in grilles?



Style 2V Supply Grille
Two sets of adjustable louvres, front vertical, rear horizontal.



Style 3H Return Air Grille
One set of horizontal fins fixed down at 45° deflection... Also available in 0° deflection.

55 YEARS' EXPERIENCE

Since 1902, the Waterloo Register Company has been a leader in the development of registers and grilles for air conditioning, heating and ventilating applications. This 55 years of experience helps us make the finest equipment available today.

EXCLUSIVE DESIGN

Waterloo registers and grilles feature the silent flow "tear drop" louvre design, which allows a streamlined flow of high-velocity air, maintaining the required throw at the most efficient level.

QUALITY CONTROL

Every Waterloo register and grille is manufactured in a modern plant using the most efficient manufacturing techniques. There is rigid inspection at every vital step.

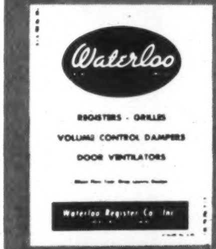
WIDE RANGE LINE

Whatever your specific needs, you will find the unit you want in Waterloo's complete line of supply and return registers and grilles. We also manufacture quality volume control dampers and door ventilators.

FAST SERVICE

Waterloo delivers . . . when you need it! Specials can be turned out in a hurry to meet job requirements.

These are *five* good reasons why it pays to make Waterloo your *buy-word*.



Waterloo

REGISTERS · GRILLES
VOLUME CONTROL DAMPERS
DOOR VENTILATORS

Waterloo Register Co. Inc

Write for Catalog, containing complete data on all Waterloo air diffusion equipment.

WATERLOO
REGISTER CO., INC.
WATERLOO, IOWA

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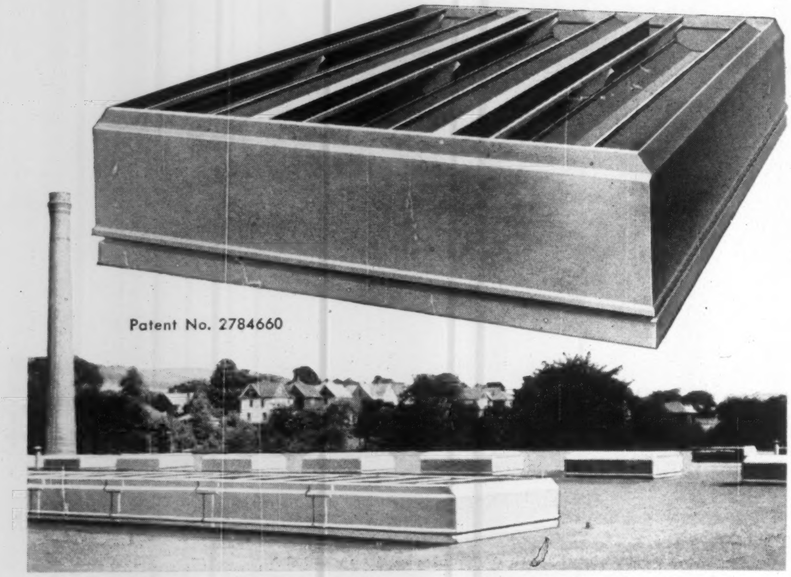
REGISTERS • GRILLES • VOLUME CONTROL DAMPERS • DOOR VENTILATORS



Lower Contour, Higher Efficiency in roof ventilators, at Lower Cost with Swartwout's new

Contouramic

Airmover®

Nearly a foot lower than any roof ventilator previously offered, Contouramic Airmover follows the trend to neater roof appearance. But there's no sacrifice of efficiency! In fact, capacity is *increased* — and many other advantages follow:

With less bulk, there's less weight — less wind resistance — lower maintenance — lower first cost.

And automatic opening of dampers in case of fire is added as a standard feature.

Contouramic Airmover can be used in various ways: for "spot" ventilation over heat-producing operations; for safety ventilation above stages; and in runs or complete roof coverage to achieve large scale ventilation. And it's absolutely weatherproof.

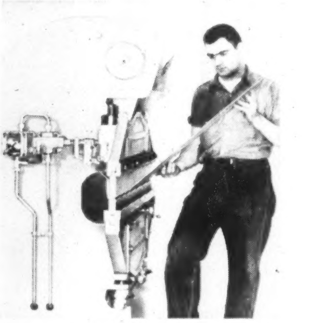
Use this newest concept in roof ventilation on new buildings or for added relief on older ones.

Write today for Form 312-F.

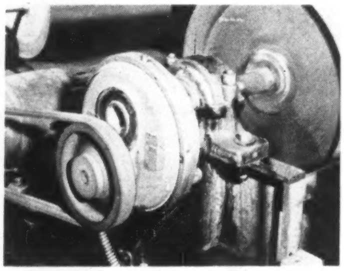
THE SWARTWOUT COMPANY
18511 EUCLID AVENUE • CLEVELAND 12, OHIO

Swartwout **ROOF VENTILATORS AND VENTILATING LOUVERS**

ALSO AUTRONIC PROCESS CONTROL EQUIPMENT



company, because speed of ram can be reduced up to 50 percent just prior to time die in ram makes contact with material to be formed. Adjustment made on calibrated gage mechanically linked to two-way valve which opens, closes to allow hydraulic oil to flow through flow control valve.



Speed Reducers . . .

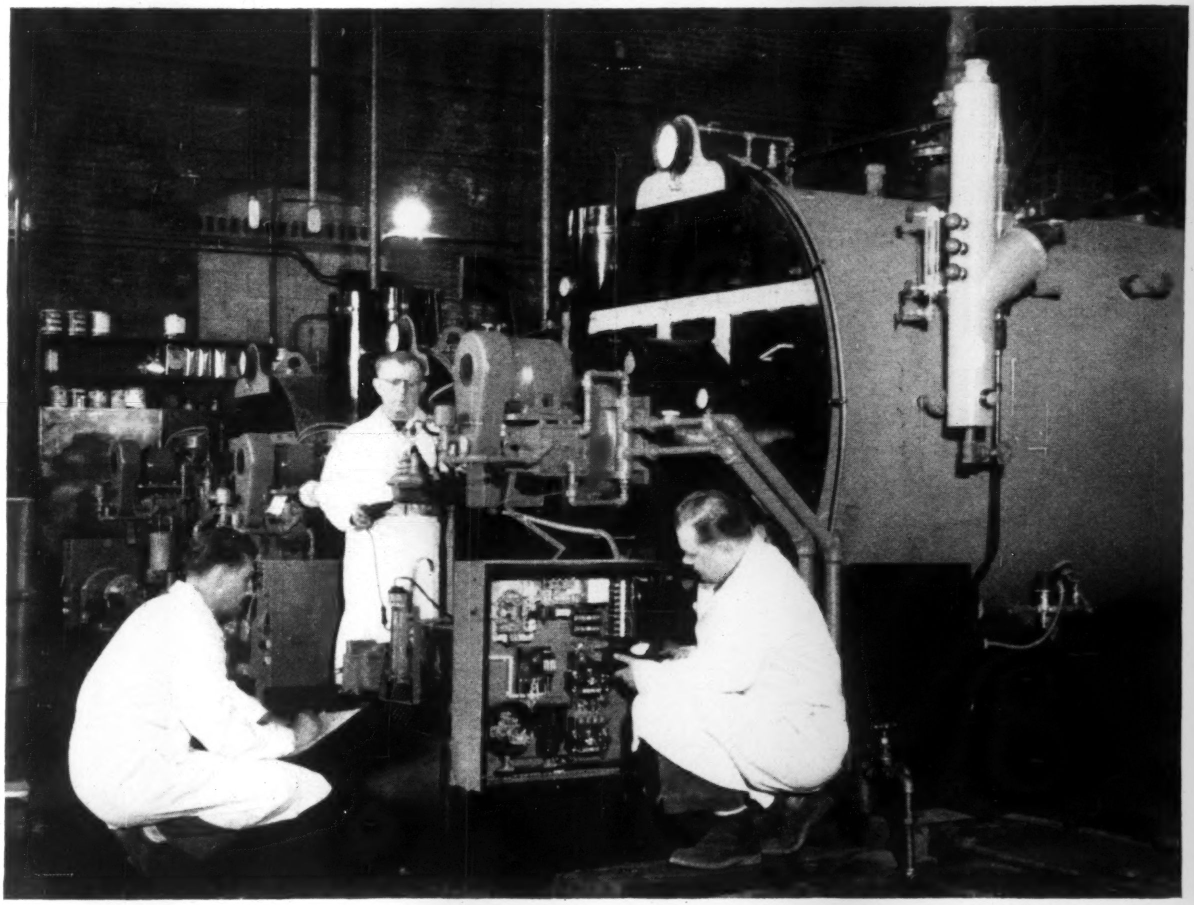
. . .line expanded to include four new 5:1 ratio units—*American Pulley Co., Dept. HPAC, 4200 Wissahickon Ave., Philadelphia 29.*

"Shaft-King" shaft mounted units provide speed range 60 to 350 rpm with use of fixed or adjustable speed "wedgbelt" drives, says company. Designed to handle loads to 25 hp. Sizes are for shafts to 2, 2 3/16, 2 7/16, 2 15/16 in. diameter.

Gas Unit Heaters . . .

. . .in two models, rated 300,000 Btu—*Reznor Mfg. Co., Dept. HPAC, Mercer, Pa.*

Models "US300-F" and "US300-B" are propeller fan and centrifugal blower powered, respectively. Ample air movement for effective heat distribution at minimum noise level



factory fire testing . . .

cuts installation costs for Superior Steam Generators

When specifications call for "all equipment installed and left in first class operating condition", it pays to install Superior Steam Generators. Fully integrated units including boiler, burner and controls, with all interconnecting piping and wiring completed at the factory, Superior Steam Generators are ready to go to work as soon as tied in to steam, water, fuel and electric lines.

And there are no "bugs" in Superior Steam Generators. Completely fire tested at the factory before shipment, and started on the job by a factory trained expert, they are your best assurance of a clean, trouble-free installation. For complete details on sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water, write today for Bulletin 804F.

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SUPERIOR
STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

The heart of the matter

IS IN THE COVERING

Available in standard pipe sizes and fittings in three thicknesses; Light, (Ice Water to 30° F.) Medium, (Brine and Ammonia to 0° F.) Heavy, (Heavy Brine—25° F. and lower.)

UNITED CORK PIPE COVERING

THE IDEAL COLD LINE INSULATOR

Improper pipe insulation can mean an excessive loss in refrigeration efficiency and dollars to the cold storage operator. It is important to get the right pipe covering insulation that will have all these advantages:

- Extremely low "K" factor
- Retains over 80% of cold loss on piping
- Easy and economical to install
- Long trouble-free life
- Fire retardant—Vermin resistant
- No capillarity

LARGER STOCKS—FASTER DELIVERY—PERSONAL SERVICE

United Pipe Coverings are available from stock for prompt delivery—to fulfill your immediate installation requirements. Mail the coupon below for additional information or the United distributor nearest you.

Corkboard Pipe Covering Tank Lagging

UNITED CORK COMPANIES

1 Central Ave., Kearny, New Jersey

UNITED BB CORKBOARD (BLOCK BAKED) Patented

Manufacturers of cork insulation for almost a half century

UNITED CORK COMPANIES, 1 Central Ave., Kearny, N.J.

Please send United Cork Catalog. I am interested in ____________

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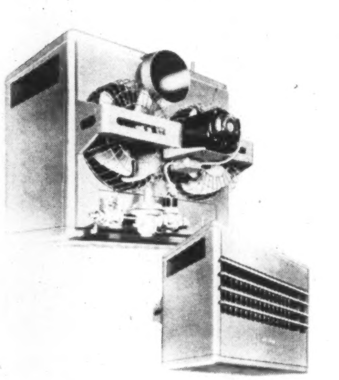
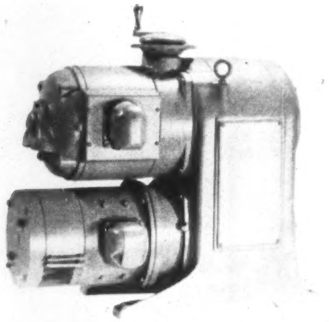
Engineering offices, or approved distributors, in key cities—coast to coast.



achieved by use of two smaller fans or blowers in place of one large one, says company. Dimensions are 33½ in. high, 36 in. wide, 40¼ or 39¼ in. deep.



Power Unit . . .

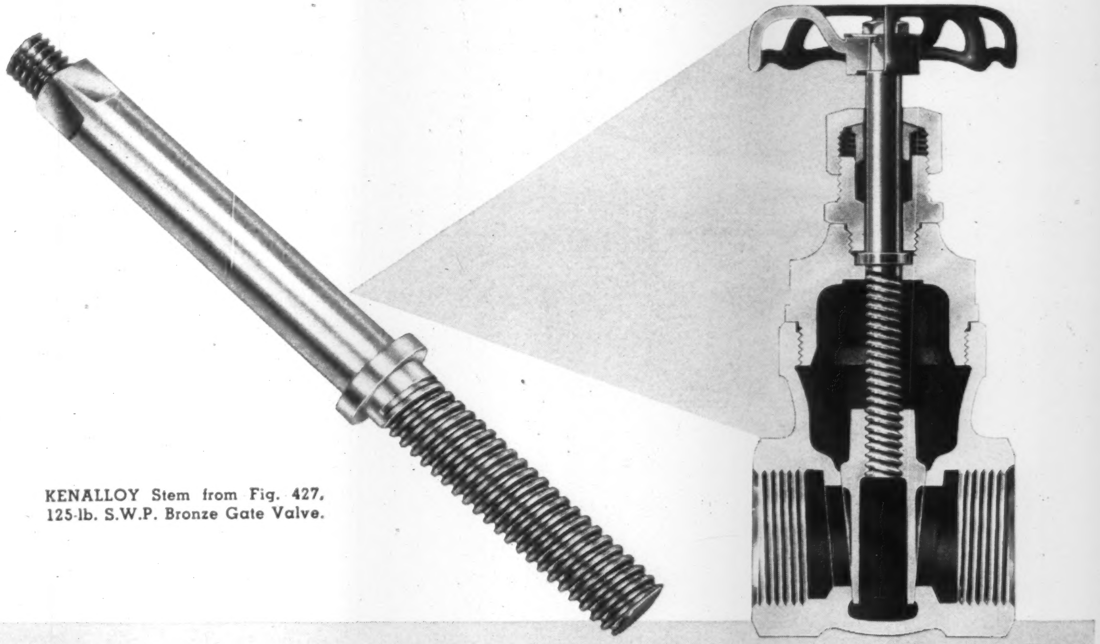
. . . for converting a-c motors to variable speeds—*U.S. Electrical Motors, Inc., Dept. HPAC, Box 2058 Terminal Annex, Los Angeles 54.*

By connecting induction motor leads to "Varidyne" power unit, motor will receive variable frequency current generated by unit, says company. Speeds are changed at power unit by means of handwheel, or remotely by mechanical or electrical remote controls. Recommended by company for applications where conditions would rule out use of other type variable speed drives.

Gas Water Heater . . .

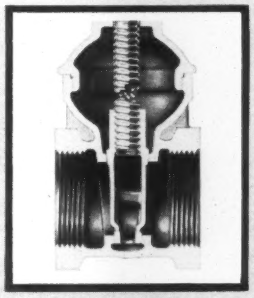
. . . for commercial, industrial water heating where draws of hot water are heavy within limited time period

Here's How KENNEDY'S Exclusive KENALLOY® Stem Gives You Easier Operation, Longer Valve Life . . .

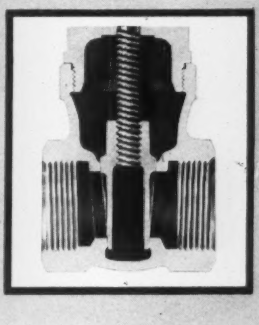


KENALLOY Stem from Fig. 427,
125-lb. S.W.P. Bronze Gate Valve.

In bronze body valves, stems made of ordinary metals are subject to a form of corrosion known as dezincification. Many fluids attack such stems in such a way as to cause the zinc to be entirely removed from the alloy. This sort of corrosion leaves the stem in a porous, very weak condition, and it soon breaks in service.



KENNEDY bronze body valve stems are made from a specially developed metal called KENALLOY. This alloy is powerfully inhibited against dezincification, as well as many other types of corrosion, and it is a long-wearing metal. KENALLOY produces beautiful, smooth threads and bearing surfaces to make valve operation easier, and it guarantees far longer life in the "heart" of the valve.



These additional advantages make KENNEDY your best valve buy . . .

The stem collar is machined for tight top seating in the bonnet recess for repacking under pressure.

Unusually deep gland-type stuffing box permits tightness without undue pressure.

New, improved impregnated plastic packing material with demonstrated superiority over other materials in maintaining resilience and resisting leakage.

Pistol-Grip handwheel that provides firm, easy three-way grip on indented top, sides and bottom.

So, write these outstanding KENNEDY valve features into your valve specifications for long, trouble-free valve performance.

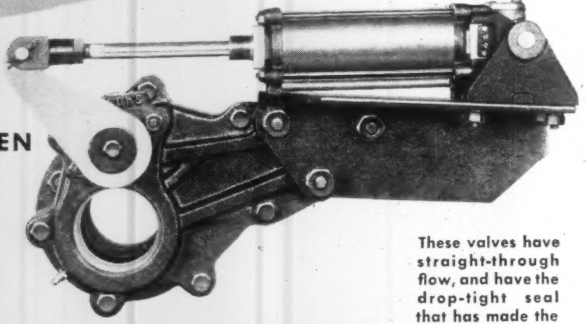
• YOU CAN'T BUY A BETTER VALVE THAN A KENNEDY

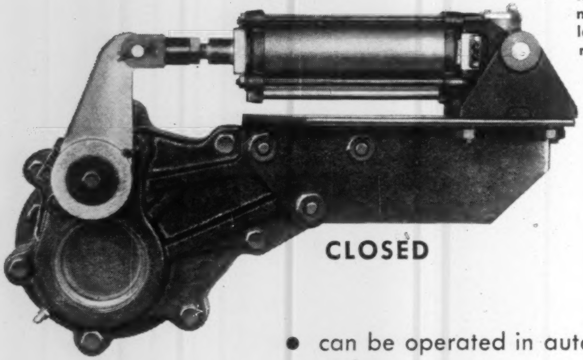
KENNEDY VALVE MFG. CO.

ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

• OFFICE AND WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •





For accurate control of process work

These valves have straight-through flow, and have the drop-tight seal that has made the non-wedging Everlasting Valve famous for 50 years.

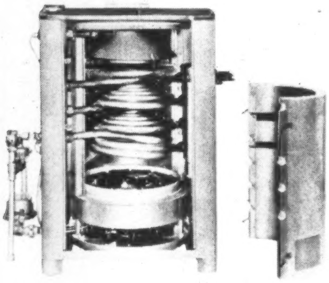
- can be operated in automatic cycles
- can be remotely controlled, electrically or manually
- can be operated by air or hydraulically
- can be regulated to operate at any speed
- eliminate operator fatigue
- allow multiple valve operation by one man

Write for complete information on these important features.

EVERLASTING VALVE CO.
61 FISK STREET JERSEY CITY 5, N. J.

EVERLASTING
CYLINDER-OPERATED Valves

EV-403



—*Ruud Mfg. Co., Dept. HPAC, Kalamazoo, Mich.*

For use with natural, mixed, manufactured, LP gases. "Model 300A" recommended by company: to meet high or intermittent peak demands in industrial plants, schools, stadiums; for sprinkler system towers; for swimming pools; for semi-continuous demands; for industrial processing. Btu input is 285,000. Recovery rate is 239.4 gph at 100 F deg temperature rise.

Nibbler . . .

. . . built for continuous production work in all types of sheet metal—*Black & Decker Mfg. Co., Dept. HPAC, 628 Pennsylvania Ave., Towson 4, Md.*

"No. 16" unit is said to punch out small, rectangular pieces, leaving smooth edge without bending or curling material. Operating on punch and die principle, tool delivers approximately 3300 strokes per min. Cannot be overloaded, operates without vibration or distortion, says company.

PHELPS DODGE
COPPER WATER TUBE
PHELPS DODGE COPPER PRODUCTS
75
NATIONAL ASSOCIATION OF PLUMBING CONTRACTORS
DIAMOND JUBILEE
DALLAS
THEY BUILDED BETTER THAN THEY KNEW

For **Mine-to-Market** *Dependability*

That Builds **Your** *Reputation . . .*

Specify **PHELPS DODGE COPPER WATER TUBE**

Packaging that's easy to stock and use.

Dependable quality that starts with highest grade copper from Phelps Dodge's own open-pit mines and is carefully controlled during fabrication.

Color-coding of tube in straight lengths for quick identification in the stockroom and on the job.

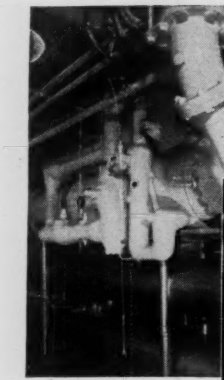
Mill depots strategically located to service distributors without delays.

Tube properties that are unsurpassed, including precise uniformity of wall thickness.

For the name of your nearest Phelps Dodge distributor, write Dept. B4, Phelps Dodge Copper Products Corporation, 300 Park Avenue, New York 22, N. Y.

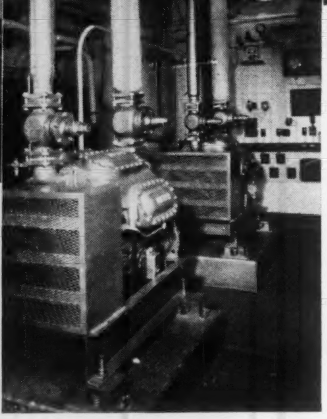
PHELPS DODGE COPPER PRODUCTS CORPORATION

NEW YORK, N. Y. • LOS ANGELES, CALIF.



Part of the Vilter air conditioning equipment at Southwestern Bell: Freon heat exchanger, 5-pass Freon water chiller, 2-pass Freon condenser, and Freon liquid receiver.

Office building, Southwestern Bell Telephone Company, St. Joseph, Missouri.



Two Vilter Freon 12-VMC compressors, complete with oil separators.

Service IMPROVES with Comfort

Q. How can the summer efficiency of many operators be increased in a busy telephone exchange?

A. with efficient Vilter AIR CONDITIONING

that costs less to own*

Busy workers throw off a great deal of heat—even though many are seated at long switchboards. Warm, "sticky" atmosphere means short tempers and reduced efficiency. BUT dependable air conditioning with proper humidity control, filtering and ample fresh air will rapidly change this. And the best solution of all is to install a Vilter system to assure efficient, economical results at a reasonable cost.

The Vilter equipment included in this telephone company installation consists of two 8-cylinder Freon 12-VMC compressors, a 2-pass Freon condenser, liquid receiver, water cooler and heat exchanger. The VMC's are designed for smooth operation, efficient performance and a minimum of vibration to reduce the noise level . . . a real asset in an office building.

A high point of the application is the attractiveness of this installation. Vilter, while primarily interested in utility, also exerts every effort to include eye-appeal in the design and installation of equipment.

See your nearest Vilter engineer, today, for a careful evaluation of your air conditioning and refrigeration needs.

* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

Vilter QUALITY CRAFTSMANSHIP that lasts . . . ENGINEERING DESIGN that guarantees performance

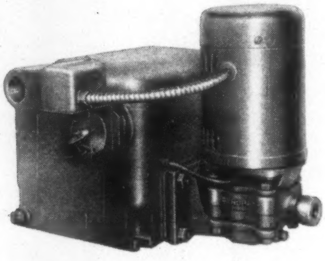
REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

EQUIPMENT DEVELOPMENTS

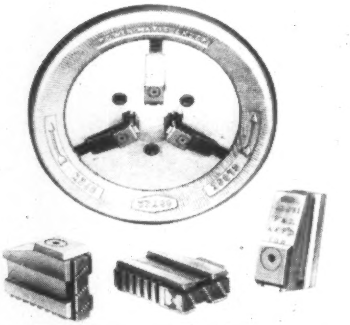
Continued



Condensation Return . . .

. . . unit in "simplex" and "duplex" models—*Aurora Pump Div., New York Air Brake Co., Dept. HPAC, 80 Loucks St., Aurora, Ill.*

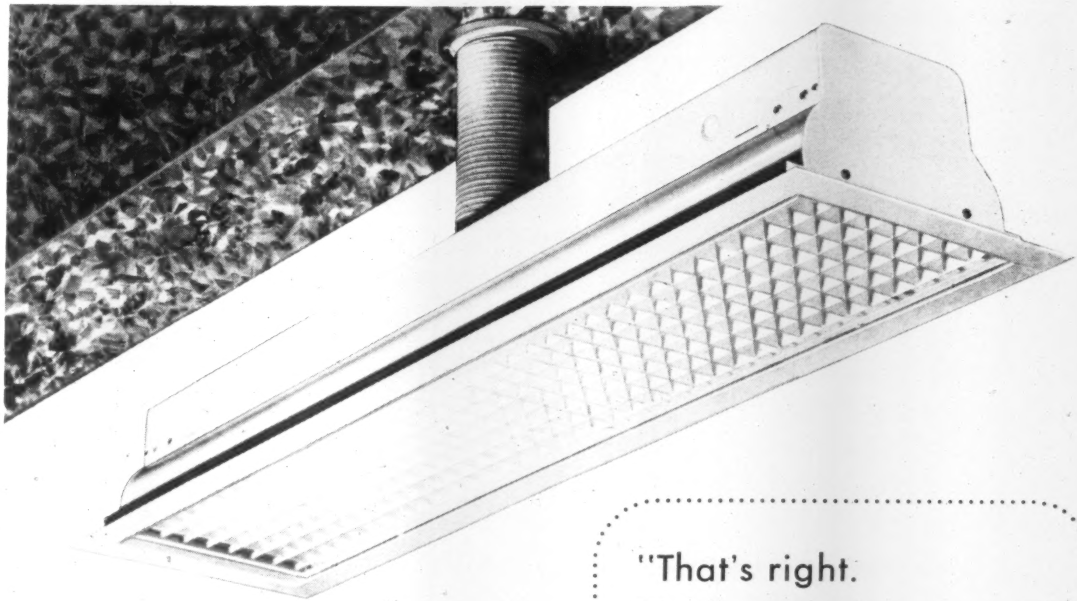
Packaged "Cond-A-Pac" ready to hook to piping, line leads, says company. Four sizes: 500-4000 EDR, unit capacity 8 gpm, simplex with 6 gal receiver, duplex with 12 gal receiver, 1/6 hp; 6000-8000 EDR, unit capacity 15 gpm, 12 gal receiver both simplex and duplex, ¼ hp. Units operate at 3500 rpm at 20 psi discharge pressure. Recommended by manufacturer for air conditioning applications.



Pipe Gripping Chuck . . .

. . . furnished on all of company's 2 in. pipe and bolt threading machines which revolve work—*Oster Mfg. Co., Dept. HPAC, E. 289th St. and Nickel Plate R.R., Wickliffe, Ohio.*

"Power-Matic" operated by hand wheel, requires no bars or tee wrenches to grip work securely for cutting both right-, left-hand threads, says company. Designed to grip pipe sizes ⅛ to 2 in., bolts or solid stock ¼ to 2 in.



"That's right.
It's the new
MULTI-VENT TROFFER
The air diffuser
is completely concealed
in the flush light fixture!"

"You mean you get
both air *and* light
from the same unit?"

There's more to the new **MULTI-VENT TROFFER** than meets the eye!

It combines a great advance in gently diffused, draft-free air conditioning, with modern, highly efficient lighting at a substantial savings in cost!

Complete concealment of the air diffuser within the handsome light fixture means freedom for the architect to design clean, uncluttered ceilings, greatly simplified mechanical planning for the engineer and . . . for the contractor . . . faster, easier field installation.

Write for detailed literature and the name of the representative in your area.

multi-vent

DIVISION OF
THE PYLE-NATIONAL COMPANY

1373 N. Kostner Avenue, Chicago 51, Illinois

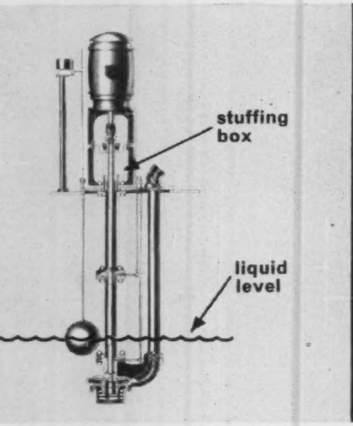
WHERE QUALITY IS TRADITIONAL

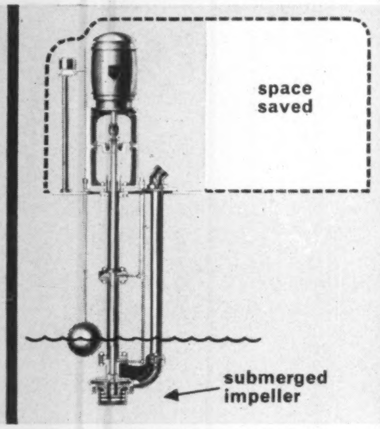
Multi-Vent® by The Pyle-National Company—Trofferlite by Benjamin Electric Mfg. Co.

SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA

you stop leakage, save space, and cut costs with Yeomans

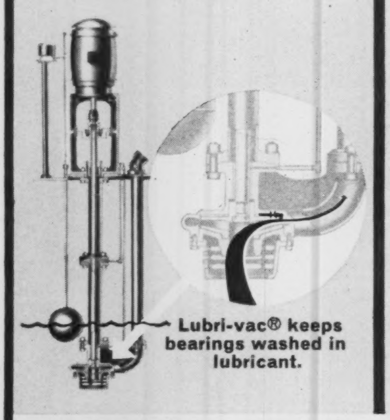
VERTICAL WET PIT PUMPS

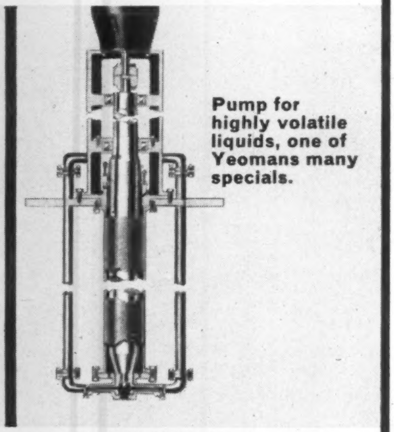




ELIMINATE LEAKAGE. Stuffing boxes and seals are not under liquid pressure. With the Yeomans Vertical Wet Pit Pump there are no costly, annoying, or dangerous liquid leaks, as with horizontal pumps.

SAVE FLOOR SPACE. They use less than half the space required by horizontal pumps. Also, no priming equipment is needed as with suction lift horizontals. Impellers are submerged in the liquid ready for service.




Pump for highly volatile liquids, one of Yeomans many specials.

CUT MAINTENANCE COSTS. With exclusive Lubri-vac® bearings are kept free of abrasive matter. Lubricant pressure prevents fluids from working into bearings. Result: Bearing failures are 90% less than with conventional vertical wet pit pumps.

SPECIAL DESIGNS. 59 Years of experience has enabled Yeomans to develop many excellent special designs for pumping "problem materials." All pumps can be furnished with ferrous and nonferrous alloy parts as required.

Capacity range from 5 to 10,000 g.p.m.

YEOMANS

Manufacturers of: pumps for drainage • sewage • condensation return • water supply and circulation • equipment for treatment of domestic and industrial wastes.

Yeomans, 2000-5N. Ruby Street, Melrose Park, Illinois

Please send me the catalog on Yeomans Heavy-Duty Vertical Wet Pit Pumps for...

☐ solids-free liquids

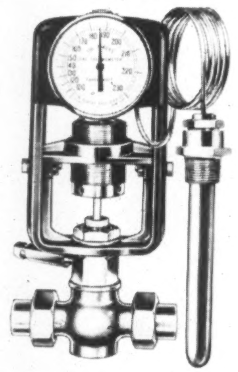
☐ solids-bearing liquids

name__________

company__________

street__________

city__________ zone_____ state__________



Indicating Regulator . . .

. . . engineered to give accurate, easy-to-read temperature check of process being controlled—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

"No. 11" self operating unit has 4 in. dial. Since indicator is mounted on front of regulator, entire unit can be used in tight spaces where other units will not fit, says company. Front mounting is also said to decrease chances of damage to indicator. Ranges available for temperatures 60 to 260 F.

SPRAYING SYSTEMS COMPANY 1/2 GG3090HC

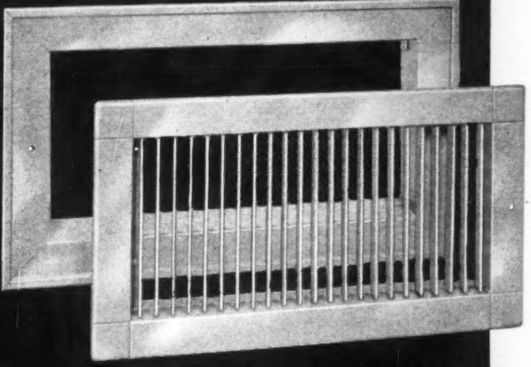
Spray Nozzles . . .

. . . designed to offer wide range of capacities from 1.5 to 1100 gpm, all with relatively small diameter spray pattern—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

"Hollowjet" units made in pipe connection sizes 1/4 to 5 in. in brass, steel, stainless steel. At 40 psi, nozzles produce spray with 30 deg spray angle, says company. Recommended

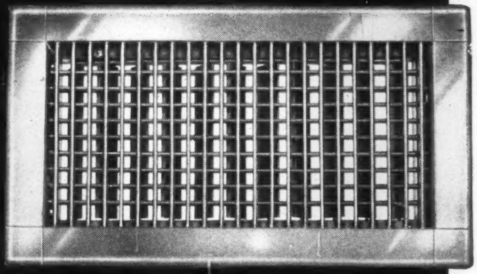
NOW *A Thoroughly Practical*
INSTALLATION FRAME FOR ALL
COMMERICAL TYPE
REGISTERS & GRILLES

For quick, easy and solid installations under all conditions, or to meet special requirements, the H&C No. 9 Installation Frame has been developed for use with H&C TRIPL-AIRE and FIXT-AIRE commercial type registers and grilles. It may be installed either before or after plastering. In the former case, the frame overlaps the opening 1 3/8" and protrudes from the wall 1/4". Sponge rubber gasket prevents leakage. For a flush installation the frame is embedded in the plaster, the formed edge acting as a plaster lock.



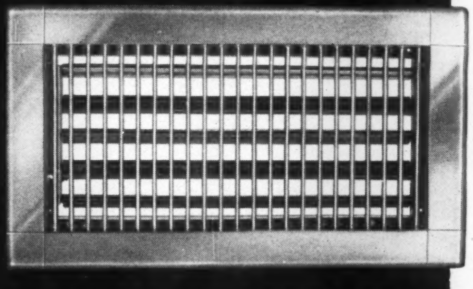
NO. 9 INSTALLATION FRAME

with No. 92V00 TRIPL-AIRE® GRILLE.



NO. 92 VHV TRIPL-AIRE®
MULTI-DEFLECTION REGISTER

Vertical face bars, horizontal secondary bars, vertical louvers.

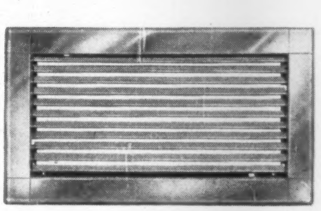


NO. 93V FIXT-AIRE® REGISTER

Vertical front bars set straight, horizontal louvers.

H&C TRIPL-AIRE®
and FIXT-AIRE®
REGISTERS and GRILLES

Ideal for every type of commercial installation. They supply every possible combination of airflow deflections desirable (over 260 combinations from stock items alone). They're extremely well made and good looking. Finished in H&C DECORATOR-GRAY Available at all H&C Jobbers. Write for catalog with complete engineering data.



NO. 94A
FIXT-AIRE® GRILLE

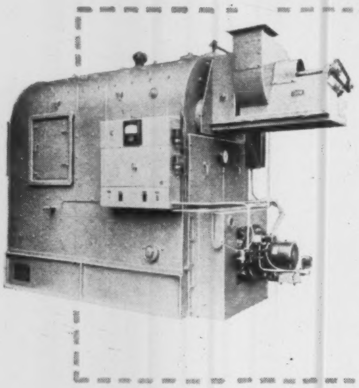
Horizontal face bars set at 22° angle to conceal duct.

MEMBER INDOOR COMFORT

HART & COOLEY
MANUFACTURING COMPANY

2-AC EAST EIGHTH STREET, HOLLAND, MICHIGAN
IN CANADA: HART & COOLEY MANUFACTURING CO.
FORT ERIE, ONTARIO

Take Your Choice...
INTERNATIONAL
Water Tube



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. . . combining the outstanding performance features of an International boiler with a nationally approved burner delivered separately, installed and serviced by a qualified local distributor.

Both give you the same outstanding advantages and economies of International water tube boiler design . . .

- Ample Furnace Volume—low heat release rates
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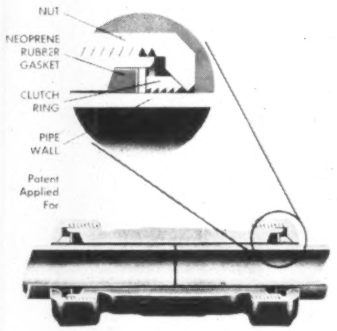
810 Spruce St. East Stroudsburg, Pa.

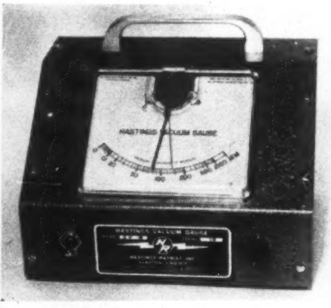
by manufacturer for applications where concentration of pattern area is necessary.



Threadless Fittings . . .

. . . designed to withstand traction forces to 3600 lb, hydrostatic pressures 450 psi on 2 in. pipe to 5000 psi on ½ in. pipe—*Telsco Fittings Div., Dept. HPAC, 5422 Redfield St., Dallas.*

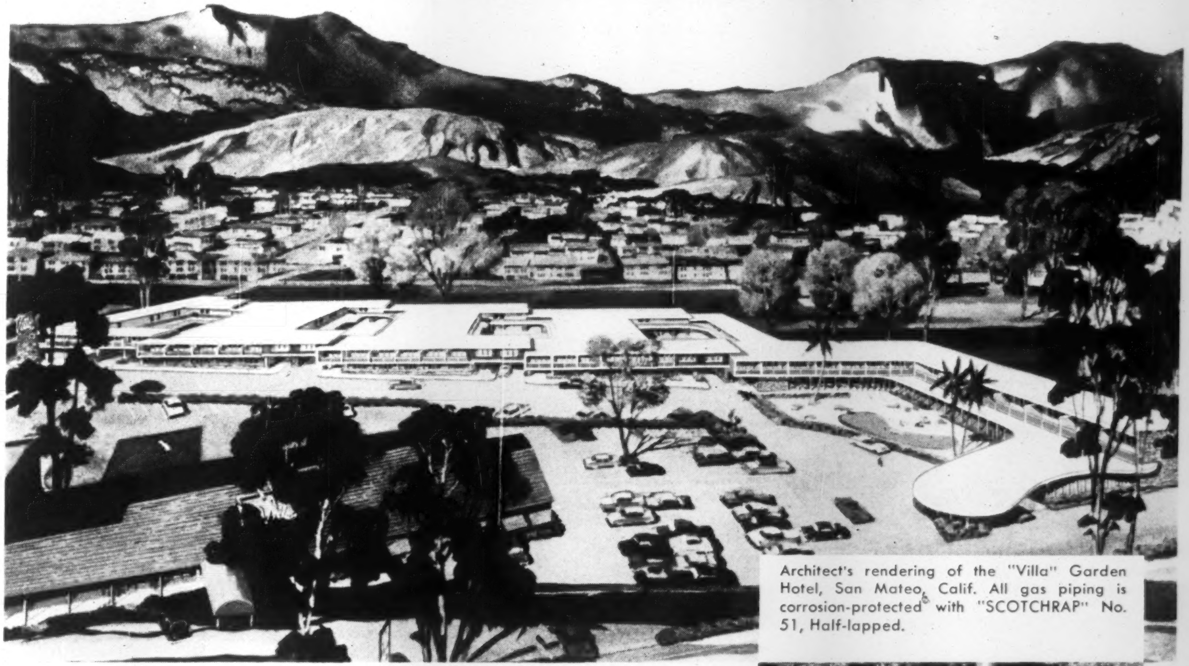
Fittings factory assembled, ready for use in joining steel, wrought iron, plastic pipe. No threading, grooving, flaring, soldering, welding necessary, says company. Gripping action achieved through specially designed brass clutch ring with internal serrations which grip pipe wall as fitting nut is tightened. At same time, neoprene gasket is compressed against pipe wall. Available as couplings, adapters, 90 deg elbows, tees.



Vacuum Gages . . .

. . . with single-contact relay control for auxiliary circuits—*Hastings-Raydist, Inc., Dept. HPAC, Hampton, Va.*

In three ranges: zero to 100



Architect's rendering of the "Villa" Garden Hotel, San Mateo, Calif. All gas piping is corrosion-protected with "SCOTCHRAP" No. 51, Half-lapped.

Modern as they come... with SCOTCHRAP protection!

REG. U.S. PAT. OFF.
BRAND

The "Villa" Garden Hotel, San Mateo, Calif., is the ultimate in this new type of hostelry. Everything about it is the best and most up-to-date obtainable. This includes the things guests never see . . . like the underground gas piping that is protected from corrosion by a continuous application of "SCOTCHRAP." "SCOTCHRAP" is tough, conformable polyvinyl chloride plastic, with pressure-sensitive adhesive in roll form. Application is quick, easy, clean—no heat, no fumes, no mess. This modern covering resists acids, alkalies, electrolytic corrosion. Available in standard widths and thicknesses.

40-foot lengths of 3½ and 4-in. pipe were shop-wrapped with "SCOTCHRAP". For special bends, cuts, and welds, "SCOTCHRAP" was removed from section, then re-wrapped by hand.

REG. U.S. PAT. OFF.

SCOTCHRAP

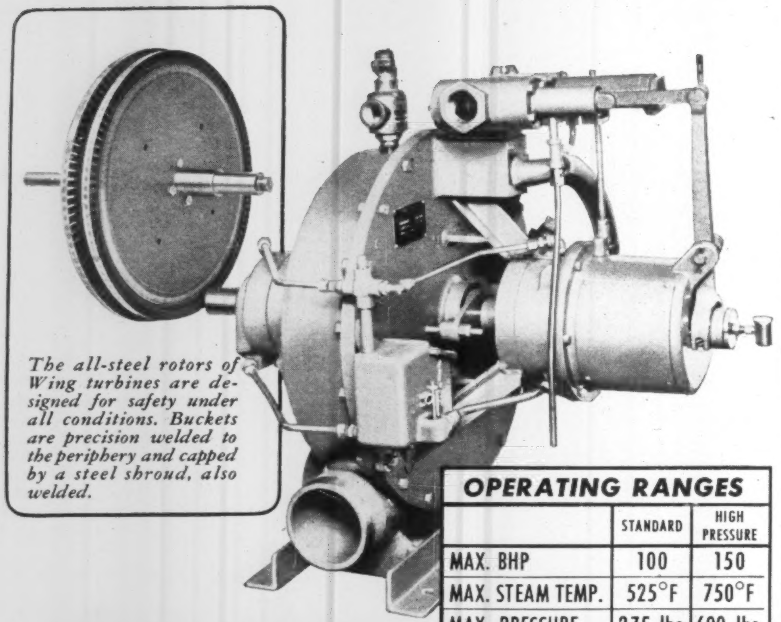
BRAND

PIPE INSULATION

. . . by the makers of "SCOTCH" Brand No. 33 Electrical Tape

The terms "SCOTCHRAP" and "SCOTCH" are registered trademarks of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P. O. Box 757, London, Ontario.

Joints, tees, and fixtures were quickly, smoothly, and tightly wrapped for continuous protection with "SCOTCHRAP." **For further information, write 3M Co., St. Paul 6, Minn., Dept. PD-67.**



The all-steel rotors of Wing turbines are designed for safety under all conditions. Buckets are precision welded to the periphery and capped by a steel shroud, also welded.

OPERATING RANGES	STANDARD	HIGH PRESSURE
MAX. BHP	100	150
MAX. STEAM TEMP.	525°F	750°F
MAX. PRESSURE	275 lbs.	600 lbs.
BACK PRESSURES to	50 lbs.	50 lbs.
SPEEDS to	4000 RPM	4000 RPM

BUILT-IN RUGGEDNESS

WING STEAM TURBINES have been manufactured by L. J. Wing Mfg. Co. for nearly half-a-century. During that time these sturdy, dependable prime movers have been giving excellent service in thousands of industrial and marine installations under the most exacting conditions of operation. They are ideal for operating compressors, generators, fans, mixers and many other types of equipment. Reliability is inherent. Use the coupon to get further details.

L. J. Wing Mfg. Co. 140 Vreeland Mills Road, Linden, N. J.
Factories: Linden, N.J. and Montreal, Can.

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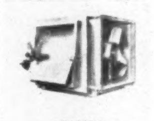
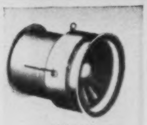
TURBINES

WING REVOLVING HEATERS



WING DRAFT INDUCERS



WING MOTORIZED BLOWERS

WING TURBINE BLOWERS

HP-6
L. J. Wing Mfg. Co.,
140 Vreeland Mills Rd., Linden, N.J.
Please send copy of Auxiliary Turbine Bulletin T-54.
Name
Firm
Address
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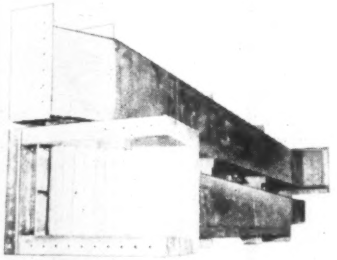
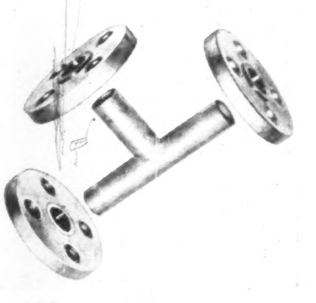
microns Hg, zero to 1000 microns Hg, 0.1 to 20 mm Hg. Adjustable contact arm on meter can be preset for control at any point within range of instrument, says company. Contact closes when vacuum pressure reaches preset position. This actuates single-pole, double-throw relay to auxiliary circuits having capacity to 5 amps at 125 volts. Instrument continues control until pressure is brought back into selected range and contact released by manual reset.



Vaned Duct Section . . .

. . . with all plastic construction—*Haveg Industries, Inc., Dept. HPAC, 900 Greenbank Rd., Wilmington, Del.*

Vaned 90 deg elbow designed for incorporation in corrosion resistant fume duct system. Made of polyester glass reinforced plastic, ducts are said to offer high corrosion resistance, very lightweight construction.

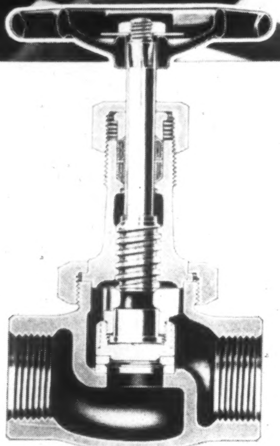


Insert Flanges . . .

. . . for maintenance and repairs in process piping, especially in hazardous areas—*Horace T. Potts Co., Dept. HPAC, Erie Ave. and "D" St., Philadelphia 34.*

Permits tying in new equipment,

IT'S TIME TO CUT *Maintenance* COSTS



LQ600

Backed by cost-cutting Distributor service . . . you can't beat the exclusive LQ600 for cost reduction. Its patented Brinalloy® seats and discs outwear even 500-Brinell or 1000-Brinell case-hardened stainless.

At no time in history have industrial valve maintenance costs been so high. Labor costs are skyrocketing. Add in your maintenance department overhead and the production time lost because of valve breakdowns, and your total maintenance cost figure is pretty close to the danger mark. The price of an ordinary valve is actually dwarfed by the cost of keeping it in operation. That's why it always pays to install *the best valves you can buy.* For nearly a hundred years, they've been made by The Lunkenheimer Company, Cincinnati 14, Ohio.

The cost of a LUNKENHEIMER VALVE
Gets smaller . . . and smaller . . . and smaller
with each passing year of dependable service.

BRONZE • IRON • STEEL • PVC

LUNKENHEIMER®

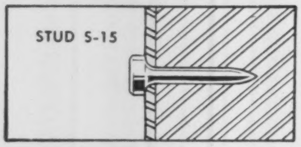
THE ONE *Great* NAME IN VALVES

L-557-10

Just one of *101* Stud Driver uses!

No outside power source required—

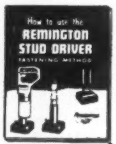
Fasten duct straps to concrete or steel in seconds with the Remington Stud Driver



Fastening duct straps to steel or concrete is easy with a Remington S-15 Stud and a 22 caliber Power Load. No bolts or washers needed . . . pull-out resistance—over 2 tons!

Squeeze the trigger and the job's done—without pre-drilling! This cartridge-powered fastening tool sets both ¼″ or ⅜″ diameter studs arrow-straight into steel or concrete . . . up to 6 studs a minute, either size. Barrel change-over takes only 90 seconds *right on the job.* Over 40 Remington Studs to choose from, plus 22 and 32 caliber Power Loads scientifically graded to furnish *exact* power you need. Use the tool for light, medium and heavy-duty fastening—and save time and money on every installation!

TAKE ADVANTAGE of this modern fastening tool in your own work. Clip and mail coupon for valuable booklet.



Remington

DU PONT

STUD DRIVER

Industrial Sales Div., Dept. HPA-6
Remington Arms Company, Inc.
Bridgeport 2, Conn.

Please send me your free booklet which shows how I can speed the job and save with the Stud Driver.

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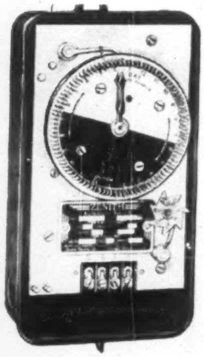
*Firm*________
*Address*________
*City*________ *State*________

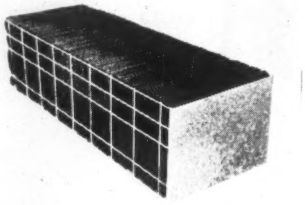
breaking into existing lines and headers without welding, says company. "Speedline" units are said to minimize downtime; give strong, leakproof joints. Press fit between insert and flange designed to assure that pipe or fitting can be expanded into ferrule permanently and further facilitates usage in that only one piece has to be handled.



24 Hr Time Switch . . .

. . . engineered for automatic control of intermittently operated equipment —*Zenith Electric Co., Dept. HPAC, 152 W. Walton St., Chicago* 10.

Designed to handle as many as 48 *on,* 48 *off* operations in one day. Cited applications include heating and air conditioning equipment, oil and gas burners, stokers. Control dial, scaled in 15 min graduations, used to set up operating schedule. Running periods set by sliding trip levers in or out on dial.



Cooling Tower . . .

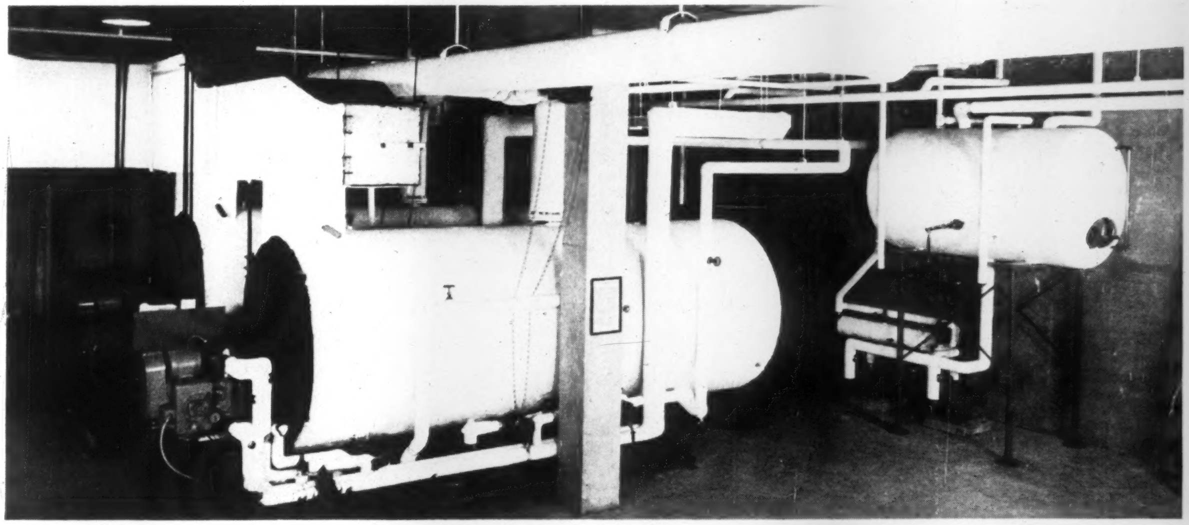
. . . with plastic cooling deck—*Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

"Acme-Pak" deck is said to be very light in weight; to resist cor-

The job dictates the insulations

...and the tough ones call for K&M

...because K&M offers a heat insulation for every purpose, factory service when you need it, and a nationwide network of skilled insulation contractors. Write today for complete information.



At Buffalo Municipal Airport, Cheektowaga, N. Y., boilers, equipment, and steam lines are insulated with K&M "Featherweight"® 85% Magnesia; hot water and return lines insulated with K&M Air Cell Pipe Covering. Heating Contractor: G. A. Dyce; Insulation Contractor: E. J. Eddy, Inc.; both of Buffalo, N. Y.

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KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

Los Angeles County Engineers Building
SAVES $13,300 in AIR CONDITIONING
with KOOLSHADE SUNSCREEN

Problem: The Los Angeles County Engineers Building was to be air conditioned. The building was equipped with Venetian blinds, but the engineers investigated several other window-shading devices in search for one that would do a better job of cutting air conditioning requirements.

Solution: Tests proved that solar heat transmission through the blinds—even when tightly closed—amounted to 1,102,000 BTU's. With KoolShade, only 232,000 BTU's. In refrigeration requirements, the difference amounted to 72 tons! Costwise, this reduction in tonnage adds up to a net saving of $13,300 over and above the cost of the KoolShade . . . and to this must be added the substantial annual savings from lower operation and maintenance of the cooling equipment.

By keeping the heat and glare of the sun *outside* the building, KoolShade Sunscreen eliminates hot spots and excessive loads . . . provides a balanced and trouble-free installation.

Only KoolShade Sunscreen offers

- **unsurpassed shading efficiency**—keeps up to 87% of the sun's rays off windows during the hottest part of the day—100 sq. feet of KoolShade reduces air conditioning load 1 ton.
- **80% clear visibility**—admits maximum glareless light.
- **harmony with all architecture**—improves building's appearance.
- **virtually no maintenance**—constructed of strong preoxidized bronze strips, wired and framed together, lasts for years, withstands hard blows.

Send today for this detailed and illustrated bulletin. And for expert help in cutting costs and sun problems, just request a call from a KoolShade engineer. No obligation or charge.

Distributor franchise still open in many communities for those who qualify.

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REFLECTAL CORPORATION
A subsidiary of Borg-Warner Corp.
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Chicago 4, Ill.

We'd like to know more about KoolShade. Without obligation, please send:
☐ Free literature
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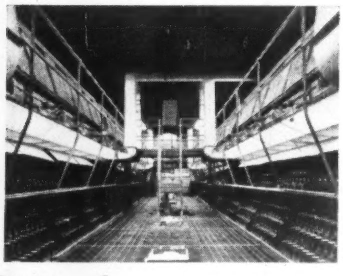
EQUIPMENT DEVELOPMENTS

Continued

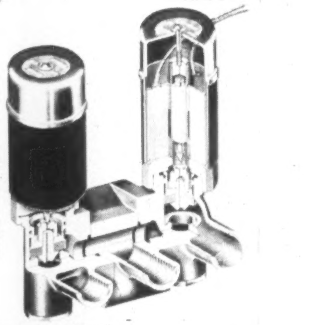
rosion, rusting, rotting; to be easy to clean. "Pak" consists of series of sheets of plastic set in close parallel proximity to each other and edgewise to flow of air and water.



Ductwork . . .

. . . made of glass fiber reinforced plastic—*Molded Fiber Glass Sheet Co., Dept. HPAC, 4304 Benefit Ave., Ashtabula, Ohio.*

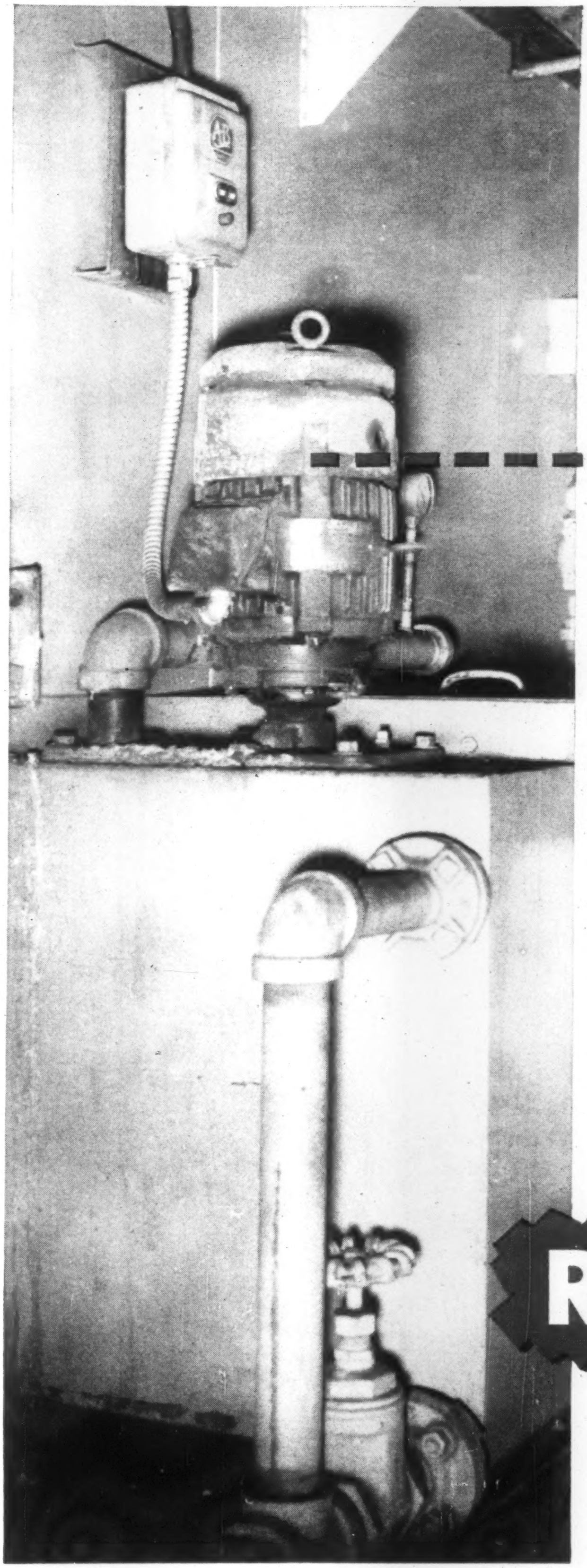
Chemical resistant, lightweight ducts fabricated in 25 ft lengths. Joints bonded to assure leakproof assembly, says company. Available in various grades of chemical resistant, flame resistant materials. Company fabricates ducts to individual specifications.



Double Solenoid Valve . . .

. . . for three-way flow control applications—*Atkomatic Valve Co., Inc., Dept. HPAC, 545 W. Abbott St., Indianapolis 25.*

Available in three assemblies for mixing, divided flow, cylinder control operations. Packless valve has two pilot-piston units, each separately controlled. For use at specific pressures 5 to 1000 psi with both pistons normally closed and at 5 to 500 psi



RELIANCE solves motor corrosion problem

This Reliance Corrosion-Proof Motor is operating a pump which circulates cleaning solution through a tank containing metal parts. The motor is subjected to corrosive vapors and liquids each time a basket of parts is removed. BUT THIS MOTOR WILL NOT CORRODE.

The solid cast-iron housing, including the fan cover, will withstand corrosive service indefinitely. Wiring identification is preserved on a stainless steel name plate. A threaded outlet is provided on the water tight conduit box, and motor leads are molded into a neoprene gasket that completely seals off the windings from the conduit box. A neoprene or non-ferrous shaft slinger seals the only other frame opening.

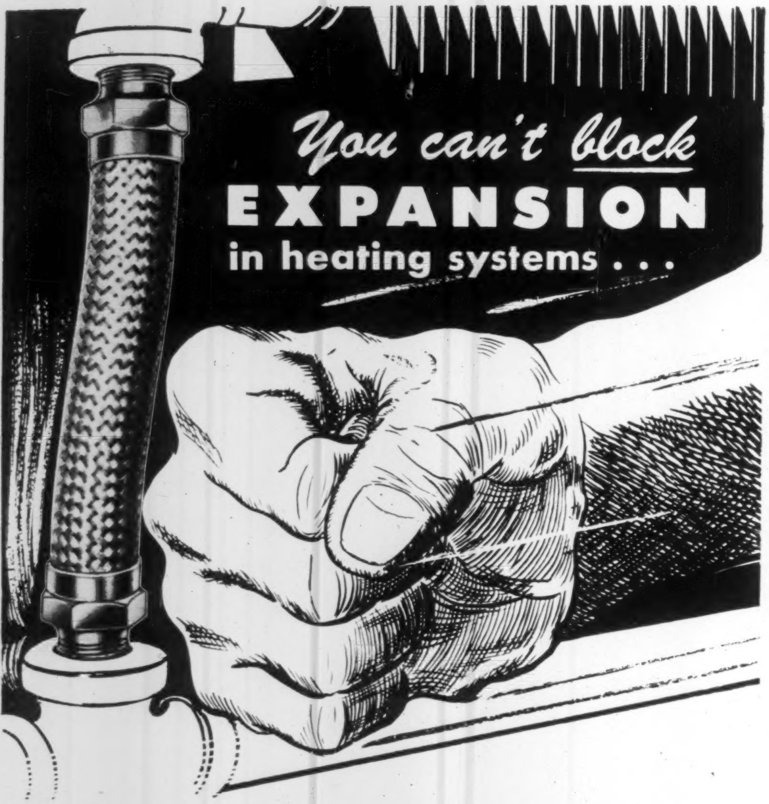
These and many other features give you a motor with a built-in corrosion protection. Why not install this superior design now and save many replacement dollars in the years ahead.

Write for bulletin B-2406 for complete design details.

B-1534

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 366A, CLEVELAND 10, OHIO
CANADIAN DIVISION: WELLAND, ONTARIO
Sales Offices and Distributors
in Principal Cities


You can't block
EXPANSION
in heating systems . . .

SO CONNECTIONS MUST COMPENSATE

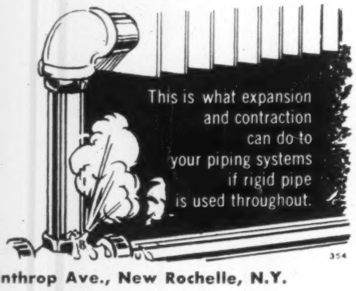
That's why Packless® is first and foremost in the design, engineering and manufacture of seamless metal flexible hose that

- *ABSORBS EXPANSION*
- *CONTROLS VIBRATION AND PIPE TRAVEL*
- *DAMPENS NOISE*
- *CORRECTS MISALIGNMENT*
- *PREVENTS PIPE DAMAGE*

A complete line of standard connectors, in sizes from ¼″ to 4″ I.P.S. are available for immediate delivery. Engineering service for *your* specific requirements is offered at no extra cost.

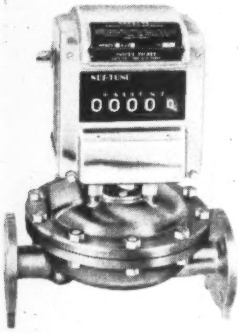
Call or write now for special technical bulletins or further detailed information. Please give us a general idea of your problem so that we may be of greater assistance to you.

Distributors and Representatives wanted: Some territories still open


This is what expansion and contraction can do to your piping systems if rigid pipe is used throughout.
354

PACKLESS
METAL HOSE INC. 730-12 Winthrop Ave., New Rochelle, N.Y.

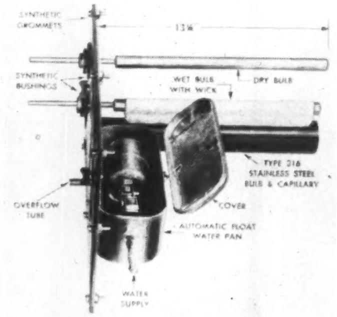
with either or both pistons normally open. Available in ½, ¾ in. sizes. May be used on air, water, oil, any fluid not harmful to Navy M bronze.



Stainless Steel Meter . . .

. . .engineered for close metered control over corrosive solutions, chemicals which must be kept pure—*Neptune Meter Co., Dept. HPAC, 19 W. 50th St., New York 20.*

Based on company's positive displacement principle, with only one moving element exposed to liquid. Is said to be highly resistant to chemical attack, maintain accuracy over long periods of service. Capacity of 1½ in. unit ranges 20 to 100 gpm for most liquids.

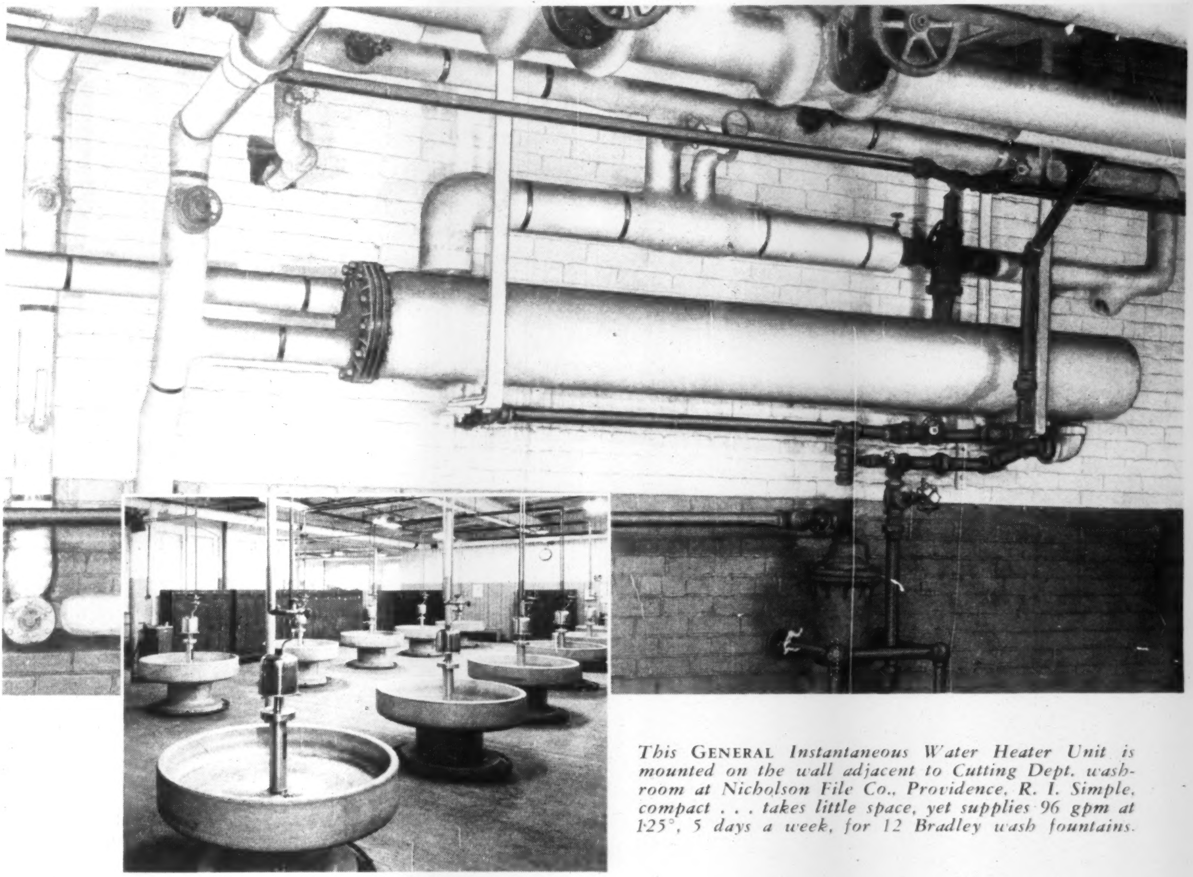

SYNTHETIC GROMMETS
13¼"
SYNTHETIC BUSHINGS
WET BULB WITH WICK
DRY BULB
TYPE 316 STAINLESS STEEL BULB & CAPILLARY
OVERFLOW TUBE
COVER
AUTOMATIC FLOAT WATER PAN
WATER SUPPLY

Thermal System . . .

. . .engineered to resist corrosive effects of smoke, gases, electrolytic action of wet bulb water—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

Shown is "Heliarc-welded 316" stainless steel wet bulb, which is heat treated, normalized, polished to elim-

Nicholson File Company "job spots" hot water supply . . . eliminates bulky tanks and long piping runs



This GENERAL *Instantaneous Water Heater Unit is mounted on the wall adjacent to Cutting Dept. washroom at Nicholson File Co., Providence, R. I. Simple, compact . . . takes little space, yet supplies 96 gpm at 125°, 5 days a week, for 12 Bradley wash fountains.*

Here's the space-saving, heat-saving way to boost hot water capacity at *any* in-plant location . . . without added construction or crowding the boiler room.

At Nicholson File Company, Providence, R. I. . . . a single GENERAL Instantaneous Water Heater, mounted on the wall out of the way, delivers plenty of continuous hot water "on the spot" for peak washroom demand periods. There are no space-consuming tanks . . . no long piping runs, no heat waste. The GF heating unit was installed quickly, easily at existing steam lines . . . cost but a fraction of conventional storage tank systems.

The job-proved economy and efficiency of GENERAL Instantaneous Water Heaters can solve *your* water heating problem as well. Use for spot installations, booster installations, or complete centralized system. Available in wide range of capacities to 300 gpm. Heated with live or exhaust steam, at 5 to 125 psi, or boiler water. Mail coupon for complete information.

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COMPANY

TANKLESS AND INDIRECT
WATER HEATERS AND HEATING SPECIALTIES

GF

GENERAL FITTINGS COMPANY
Box 151E, East Greenwich, R. I.

Please send copy of your new Catalog 61

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COMPANY ....

ADDRESS ....

CITY .... STATE ....

for a "beautiful" job of distributing air where you want it!

Specify the NEW

Lima

Flexi-Trol

COMMERCIAL AIR CONDITIONING REGISTERS and GRILLES

Completely Adjustable

- Single and Double Deflection Grilles and Registers featuring completely adjustable 4 directional air control

The attractive appearance of the new Lima Flexi-Trol air conditioning line matches the "beautiful" job it does in meeting air deflection requirements for maximum comfort and efficiency.

Features include: adjustable face bars with positive friction to prevent accidental movement . . . heavy gauge steel frame, resistance welded . . . reinforced corners for added strength . . . quiet operation without rattling or whistling . . . double overlap opposed valves . . . permanent Lima rust-resisting finish in neutral tone. Can be repainted if desired.

Write today for literature and specifications on the new Lima Flexi-Trol Commercial Air Conditioning Line.

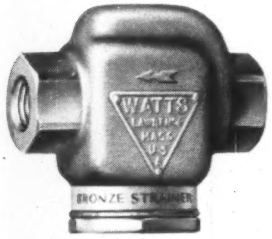
Lima REGISTER COMPANY
1796 N. Cable Rd., Lima, Ohio

sold exclusively through heating wholesalers and manufacturers

EQUIPMENT DEVELOPMENTS

Continued

inate pits where corrosion frequently starts, says company. Psychrometer mounting panel has metal parts insulated to prevent galvanic action from occurring between wet bulb and another exposed metal surface.



Strainer . . .

. . . designed for applications requiring fine straining of air, gases—*Watts Regulator Co., Dept. HPAC, Lawrence, Mass.*

All brass "Series 137" unit is said to be particularly suited for keeping regulators clean. Removable porous bronze strainer element effectively strains out particles 0.004 in. and larger (90 microns), says company. In pipe sizes 1/4, 3/8, 1/2 in. For pressures to 500 psi.

Venturi Tubes . . .

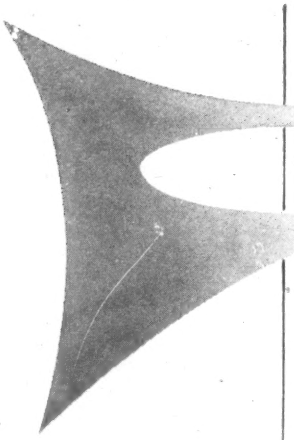
. . . with stainless steel metering sections—*Vector Mfg. Co., Dept. HPAC, 433 Old York Rd., Jenkintown, Pa.*

For liquid, gas flow metering. Are said to create low unrecovered pressure loss, require short upstream straight run of pipe. Two styles offered: complete venturi; insert style in which metering section fits into existing pipe.

Soldering Rod . . .

. . . in new flux-cored version—*Eutectic Welding Alloys Corp., Dept. HPAC, 40-40 172nd St., Flushing 58, N.Y.*

"EutecRod 157B" is said to be high strength, silver bearing, lead free alloy for stainless steel, other base metals. Self contained flux per-



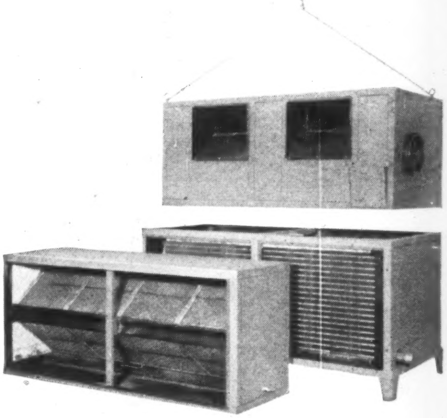
THE KENNARD *Engineered* LINE

Costs Less Installed!

Kennard Corporation planned each unit to be as complete as possible and "job ready". No hidden costs—no loss—no waiting.

Buy Kennard Engineered Air Conditioning Equipment and be sure of a profit.

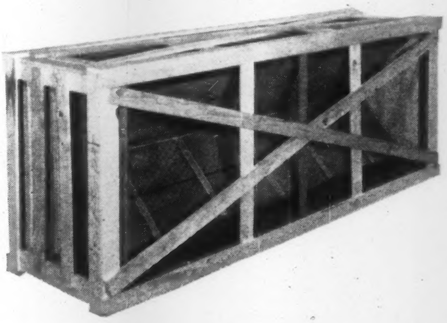
Look at these reasons . . .



VERTICAL A.C. UNIT

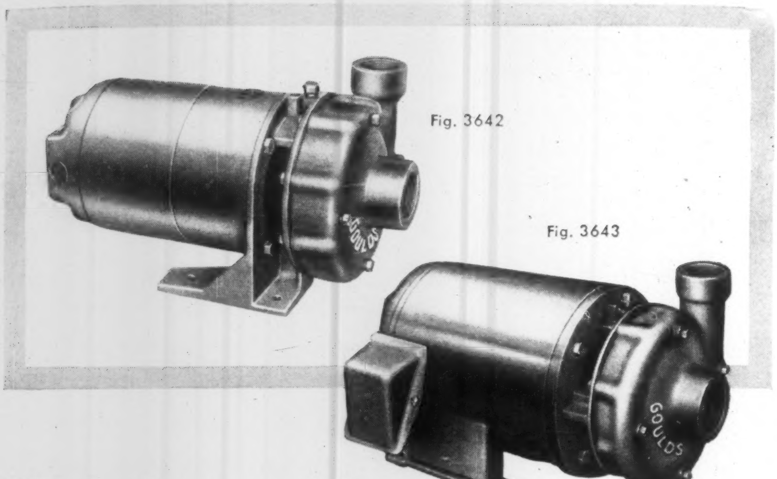
- **Each Section is Completely Factory Assembled**—A big saving of field man-hours and done by factory experts.
- **Each Section is Self-Supporting**—Makes for easy and quick bolting together.
- **Rugged Frame**—For less costly handling and rigging. The rugged welded framework gives more strength than the bolted pan type.
- **Lifting Eyes for Easier Hoisting**—This is a big help in many-storied buildings, or just rigging in the equipment room.
- **Expansion Valves are Factory Mounted and Piped**—This too represents a big saving on the job.
- **All Mating Parts are Factory Fit**—The bolt holes are jig checked before leaving the assembly line.
- **Compact Size**—Designed for space saving, but the correct size for the individual application.

- **CRATED**—Yes, Kennard crates all pieces, not just skidded. Proper Crating assures . . .
  Protection against damage in shipment.
  Protection against damage on the job.
  Saves delays. **SAVES MONEY.**
- **Reliable Shipping Schedules**—Usually a contractor's biggest headache. Kennard is proud of its record of **SHIPPING ON TIME.**



KENNARD CORPORATION
1817 HANLEY RD. • ST. LOUIS 17, MO.

Representatives in
All Principal Cities



They're ready...

in 16 size and motor combinations

Goulds "Close-Cupld" Pumps for air conditioning service

Designed especially for air conditioning systems, these rugged Goulds pumps offer:

Easy installation—Unit assembly. Just bolt it down, locate discharge in any of 8 positions, connect piping and power.

Compact, "close-cupld" construction—Saves space, and assures permanent alignment of rotating parts.

Mechanical seal—Doesn't leak, or bind the shaft, or run dry, or need adjustment or maintenance.

Quiet operation—Balanced, vibration-free impeller is only moving part driven by ball bearing motor.

These pumps are available in the sizes shown below—in all iron, bronze-fitted, or all bronze construction. Maximum temperature 212° F. Maximum working pressure 100 lbs. Full details and dimensions in Bulletin 624 A-3.

GOULDS "CLOSE-CUPLD" PUMPS FOR AIR CONDITIONING SERVICE

	Size	Motors	Capacity (GPM)	Head (Feet)
Fig. 3642	1″ 1¼″	¼ to 1½ HP ½ to 2 HP	32 to 58 70 to 110	38 to 118 36 to 102
Fig. 3643	1½″ 2½″	3 or 5 HP 3, 5, or 7½ HP	142 to 182 250 to 370	103 to 142 72 to 138

GOULDS

PUMPS FOR AIR CONDITIONING

GOULDS PUMPS, INC.
Seneca Falls, N. Y., Main Office and Works
Branches
ATLANTA, 15 Peachtree Place, N.W.
BOSTON, Room 314, 1330 Beacon St. Brookline, Mass.
CHICAGO, 53 West Jackson Blvd.
HOUSTON, 2314 Main St.
NEW YORK CITY, Room 1503, 11 Park Place
PHILADELPHIA, 2099 North 63rd St.
PITTSBURGH, Room 512 Bessemer Bldg., 140 - 6th St.
TULSA, 543 East Apache St., P. O. Box 6157

West Coast Representative: GOULDS PUMPS Western, Inc., 1919 N.W. Thurman St., Portland 9, Oregon
In Canada: The A. R. Williams Machinery Co., Ltd.... in all principal cities

EQUIPMENT DEVELOPMENTS

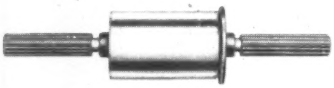
Continued

mits good tinning action, provides good control when joining, says company. Deposits are said to have good appearance, hardness, and retain high gloss despite aging. Available in ⅛, 1/16, 3/64 in. diameters.

Moisture Indicator . . .

. . . and sight glass combination for refrigeration service—*Ansul Chemical Co., Dept. HPAC, Marinette, Wis.*

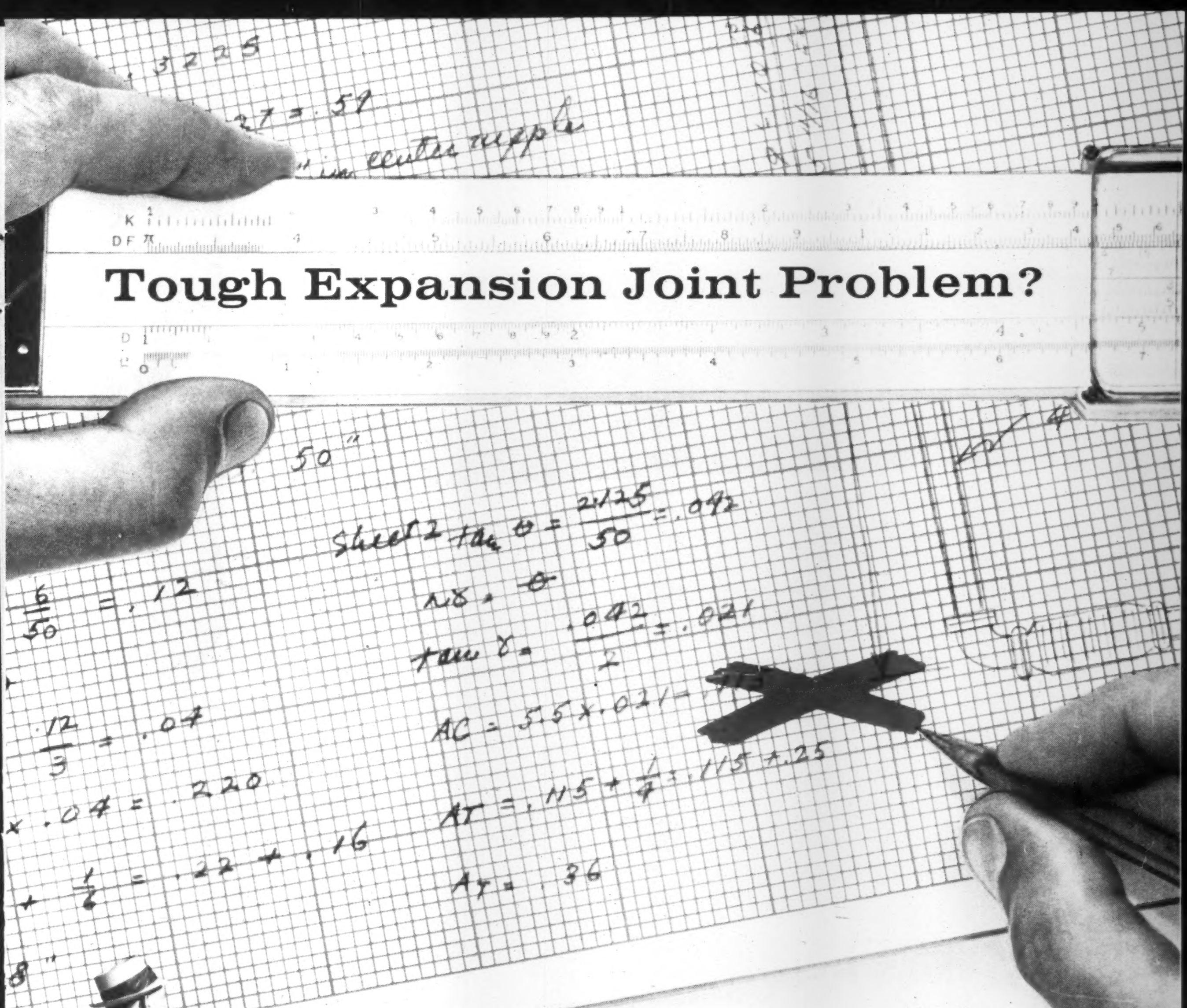
"Super Dry-Eye" designed to enable refrigeration service engineers or equipment owners to detect basic system trouble in earliest stages, prevent breakdowns. With two moisture indicating elements—one each for fluorinated hydrocarbon refrigerants Nos. 12 and 22—plus built-in sight glass. With ¼, ⅜, ½, ⅝ in. flare fittings.



Hammer . . .

. . . for Pittsburgh lock seaming sheet metal ducts—*Bell Machine Specialties, Dept. HPAC, 4813 Tremont Ave., Trevose, Pa.*

Tool is said to cut lock seaming time of sheet metal duct as much as 80 percent. "Noiseless Hammer" designed to make perfect seam every time without wrinkles or unevenness. Will handle any light gage sheet metal ducts or 26 gage steel or 0.032 in. aluminum, says company. Operation consists of flattening barrel of seamless steel tubing that rolls on steel shaft with rubber hand grips.



Tough Expansion Joint Problem?

Put the Badger Man on the Spot!

Complex expansion joint problems are *best* analyzed at only one place: your office or plant site. It's there alone — where the figuring is going on — that *all* essential data about your proposed installation is available.

And it's there — *on the spot* — that the Badger Man can assist you. Because 1. he is a trained engineer; 2. he brings to your problem the background of the world's most experienced manufacturer of expansion joints.*

Next time you are confronted with a complicated piping layout, severe operating conditions, unusual size and shape requirements — *any* complex expansion joint problem — put the Badger Man on the spot! His services are as close as your telephone.

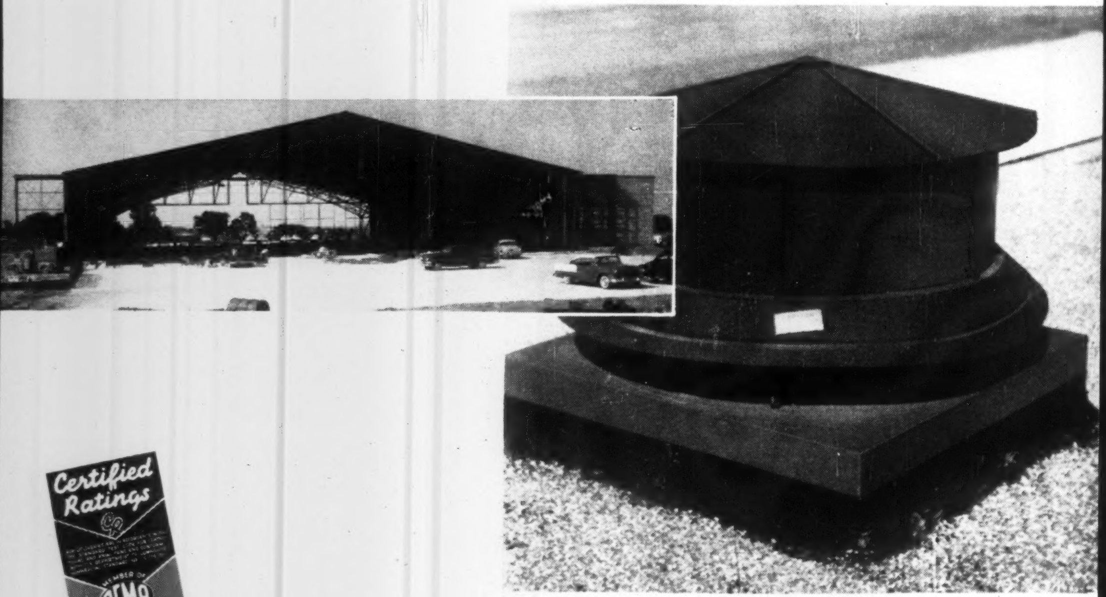
COMING SOON — Badger Service-Rated Expansion Joints. Incorporate revolutionary new features developed during three years of intensive research and testing. Watch for this important announcement.

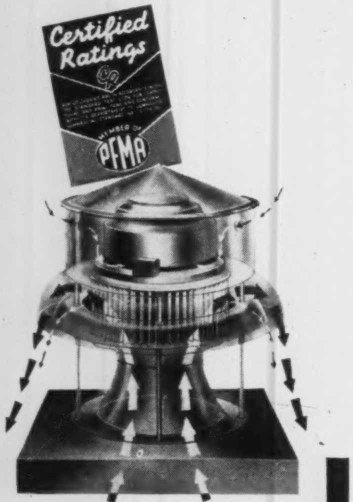
BMC

BADGER EXPANSION JOINTS
BADGER MANUFACTURING COMPANY
230 Bent Street, Cambridge 41, Massachusetts • 60 East 42nd Street, New York 17, New York
Representatives in principal cities

* Badger has been solving tough expansion joint problems for 50 years — a record unmatched by any other firm.

Gallaher Air-Vans® *approved on all counts for Air Force Reserve Training Center at General Billy Mitchell Field, Milwaukee*





150 CFM to 65,000 CFM — up to 4" S.P. Certified Ratings

In this training center combination of hangar, shops, classrooms and office space, one belt-drive and eight direct-drive AIR-VANS help to maintain ideal working conditions at all times. Odors resulting from oils, greases and exhaust vapors are held at absolute minimum. Efficient, rugged power roof exhausters were needed for this job. GALLAHER AIR-VANS were specified and approved.

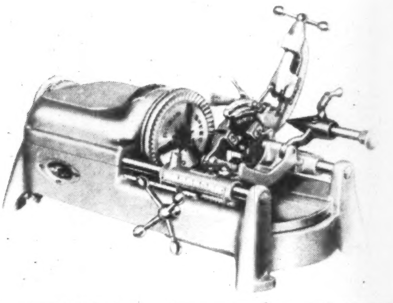
Engineers and Architects specify GALLAHER AIR-VANS for these vital features . . . Patented Scroll Design, air seal-off, low silhouette, low noise levels, availability in special metals, weatherproof design, corrosion resistant finish, certified ratings, and shipped completely assembled, on time, and ready to install.

For Further Information write . . .

The GALLAHER COMPANY

4108 Dodge Street Omaha, Nebraska

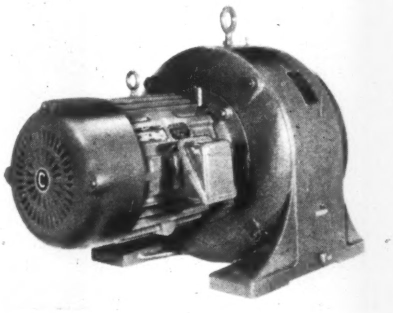
Export Office: 306 Paul Bldg., Utica, N. Y.



Pipe, Bolt Threading Machine . . .

. . . with new universal die head—*Ridge Tool Co., Dept. HPAC, Elyria, Ohio.*

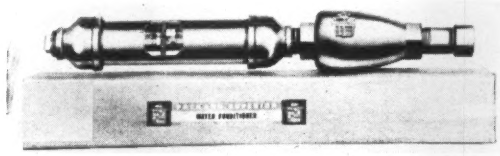
Die head, with its two sets of dies, threads ½ to 2 in. pipe or conduit. One set threads ½ to ¾ in.; other threads 1, 1½, 2 in. Complete "Ridgid 535" machine includes cutting and reaming tools including roll type cutoff with self centering, full floating cutter wheel and five-flute cone reamer with ⅛ to 2 in. capacity, says company.



Gearmotors . . .

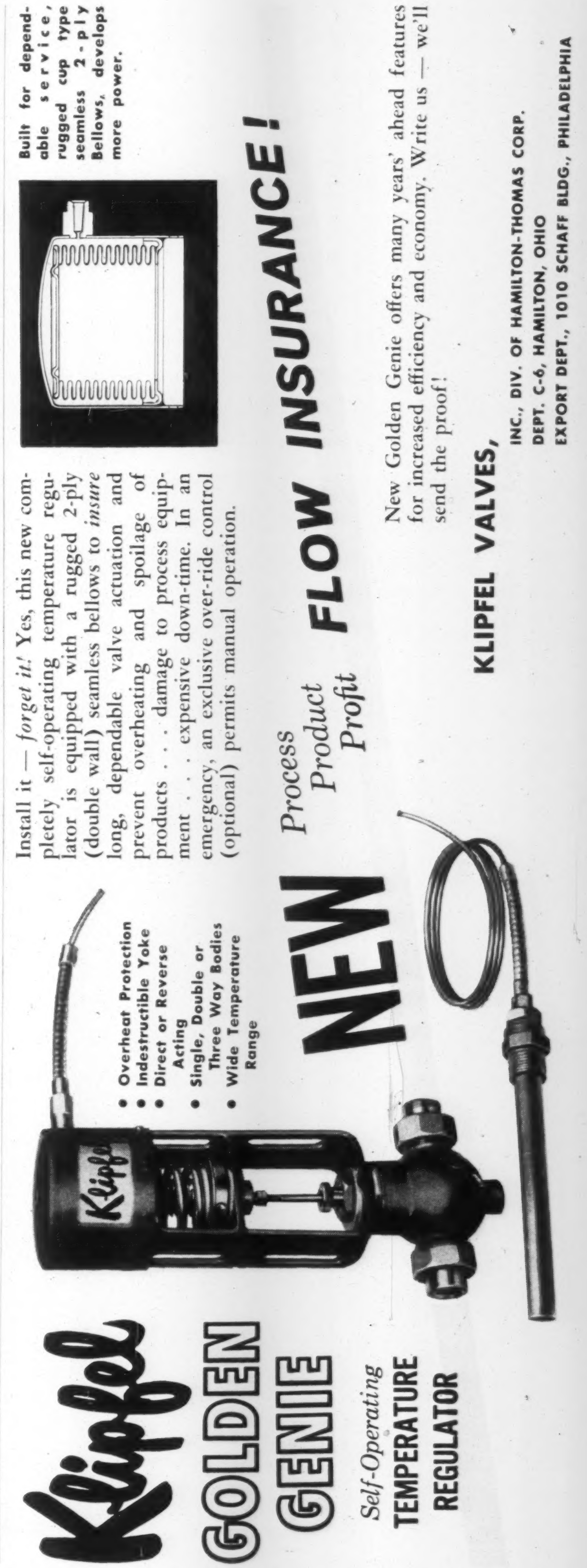
. . . engineered for "top efficiency" in slow speed power applications—*Century Electric Co., Dept. HPAC,* 1806 *Pine St., St. Louis* 3.

Units designed for increased dependability, cooler operation, maximum wear life, trouble-free service. Available with polyphase, single-phase, d-c motors. Variety of mounting positions possible, including downshaft and tilted shaft, says company. Also, can be obtained in open dripproof, dustproof, explosion-proof, totally enclosed frames.



Water Conditioner . . .

. . . designed to prevent, eliminate hard water scale, corrosion in small boilers (to 30 hp), similar low



Klipfel GOLDEN GENIE

Self-Operating TEMPERATURE REGULATOR

- Overheat Protection
- Indestructible Yoke
- Direct or Reverse Acting
- Single, Double or Three Way Bodies
- Wide Temperature Range

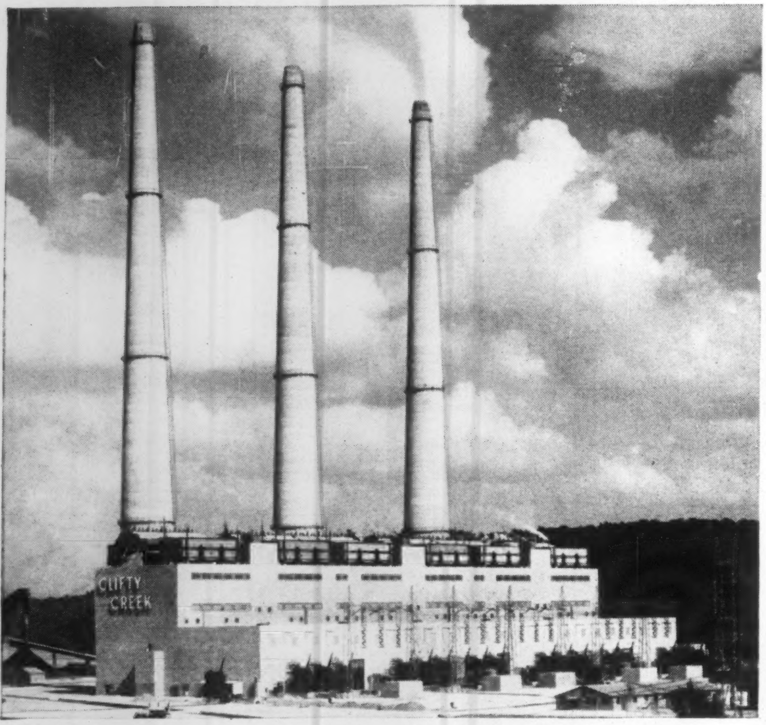
NEW *Process Product Profit* FLOW INSURANCE!

Install it — *forget it!* Yes, this new completely self-operating temperature regulator is equipped with a rugged 2-ply (double wall) seamless bellows to *insure* long, dependable valve actuation and prevent overheating and spoilage of products . . . damage to process equipment . . . expensive down-time. In an emergency, an exclusive over-ride control (optional) permits manual operation.

Built for dependable service, rugged cup type seamless 2-ply Bellows, develops more power.

New Golden Genie offers many years' ahead features for increased efficiency and economy. Write us — we'll send the proof!

KLIPFEL VALVES, INC., DIV. OF HAMILTON-THOMAS CORP.
DEPT. C-6, HAMILTON, OHIO
EXPORT DEPT., 1010 SCHAFF BLDG., PHILADELPHIA



GIANT ON THE OHIO. Clifty Creek Plant at Madison, Ind., is the world's largest investor-owned power plant—with a 1,290,000 kilowatt capacity. The complex air conditioning requirements for this "big job" were met efficiently by General Electric Zone-by-Zone method.

General Electric
ZONE-BY-ZONE
Air Conditioning chosen for largest power plant ever built by industry

When air conditioning was selected for the giant Clifty Creek power plant, the engineers chose General Electric Zone-by-Zone method. Not only was this system most economical to install—but its flexibility permits a continuing economy in cooling costs.

General Electric Air Conditioning can be installed step-by-step, if desired, so that the investment at any time can be kept relatively low. Space presents no problem—ceiling-mounted units take no floor space and floor-mounted units may be stationed out of space. These smartly streamlined units are self-contained, trouble-free. And you'll always go right specifying General Electric products.

You owe it to your clients to consider General Electric Zone-by-Zone Air Conditioning in economically planning their requirements. General Electric Company, Commercial and Industrial Air Conditioning, 5 Lawrence Street, Bloomfield, N. J.

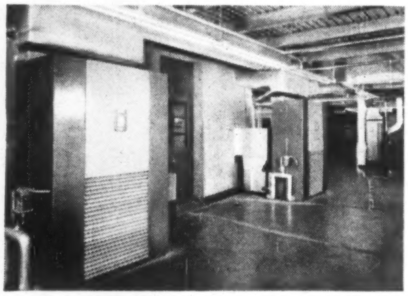
Progress Is Our Most Important Product

GENERAL ELECTRIC

In Canada, Canadian General Electric Co., Ltd., Montreal

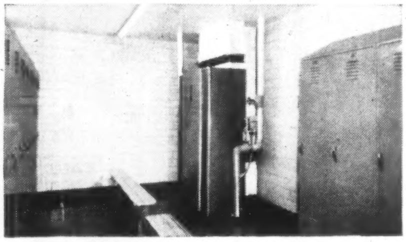
EACH ZONE INDIVIDUALLY COOLED BECAUSE EACH UNIT INDIVIDUALLY CONTROLLED

You air condition only the areas you need when you need it.

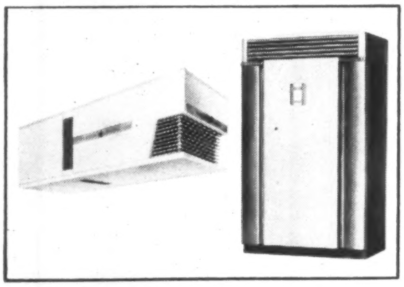


CONTROL ROOM at base of each of three stacks—tallest in the world—adequately air conditioned by 2 General Electric 10 ton Units. Third unit (located out of space) serves foreman's offices. Each of the 3 control rooms is air conditioned by General Electric Units in a similar manner.

CAFETERIA receives its cooling from a 10 ton and a 7½ ton unit. When area served is not in use, Zone-by-Zone Air Conditioners may be turned off without affecting other areas.



LOCKER ROOMS air conditioned by a 3 ton unit. In addition, all offices and laboratory have General Electric Zone-by-Zone Air Conditioning.



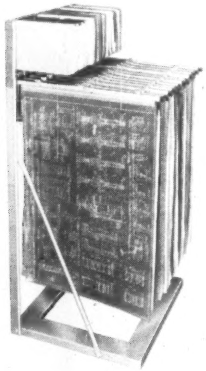
CEILING-MOUNTED UNITS *take no floor space*—available in 3, 5 and 7½ ton capacities, water-cooled; 3 and 5 ton air-cooled; **FLOOR-MOUNTED UNITS** in 3, 5, 7½, 10 and 15 ton capacities.

EQUIPMENT DEVELOPMENTS

Continued

capacity installations—*Packard Water Conditioner, Div. of Packard Mfg. Co., Dept. HPAC, 1720 Prudential Bldg., Jacksonville, Fla.*

Size is ½ in. (1½ gpm). Operates on principle using no chemicals, requiring no maintenance, says company. Consists of specially designed housings which cause water to be treated to pass through force field created by permanent alnico magnets. This is said to cause change in physical structure of dissolved minerals and salts, causing them to remain in suspension or settle out as drainable mud.



Vertical Filing System . . .

. . . for plans and blueprints, with "data file" unit mounted—*Plan Hold, Dept. HPAC, South Gate, Calif.*

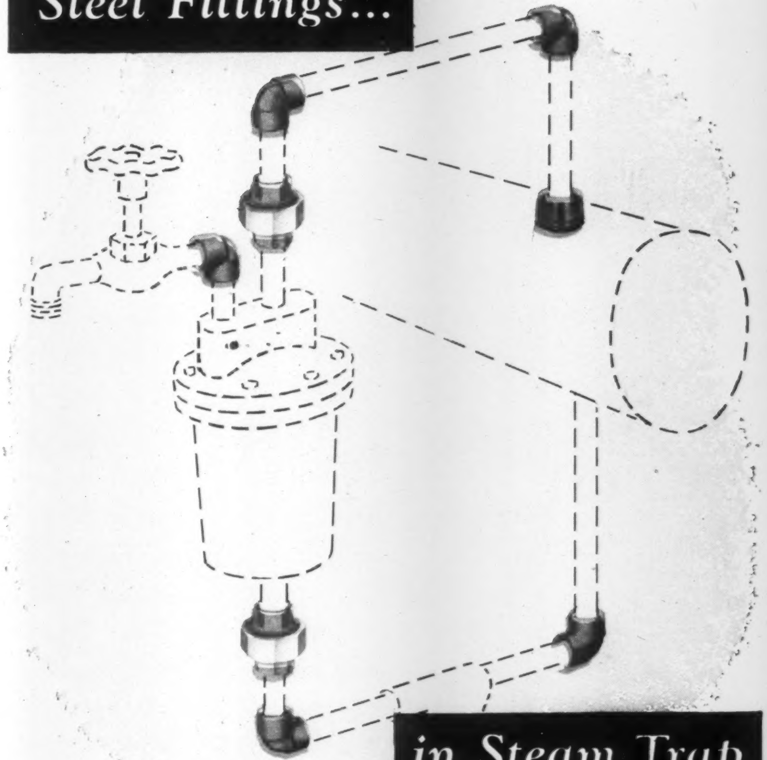
File shelf holds data and reference material while "Plan Hold" friction type binder holds blueprints below.

Light Duty Scaffolding . . .

. . . with "stainless spring lock" feature—*Carmic Mfg. Co., Inc., Dept. HPAC, 1745-53 N. Second St., Philadelphia 22.*

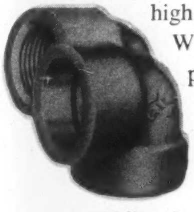
"Saf-T" frames made of high carbon steel to give lasting strength, durability, says company. For loads to 50 lb per sq ft. Locking feature made with built-in ladders, built-in coupling pins. With lightweight design, one man can move entire section, says company. Made up of four parts: two frames, pivoted cross braces.

W-S Forged Steel Fittings...

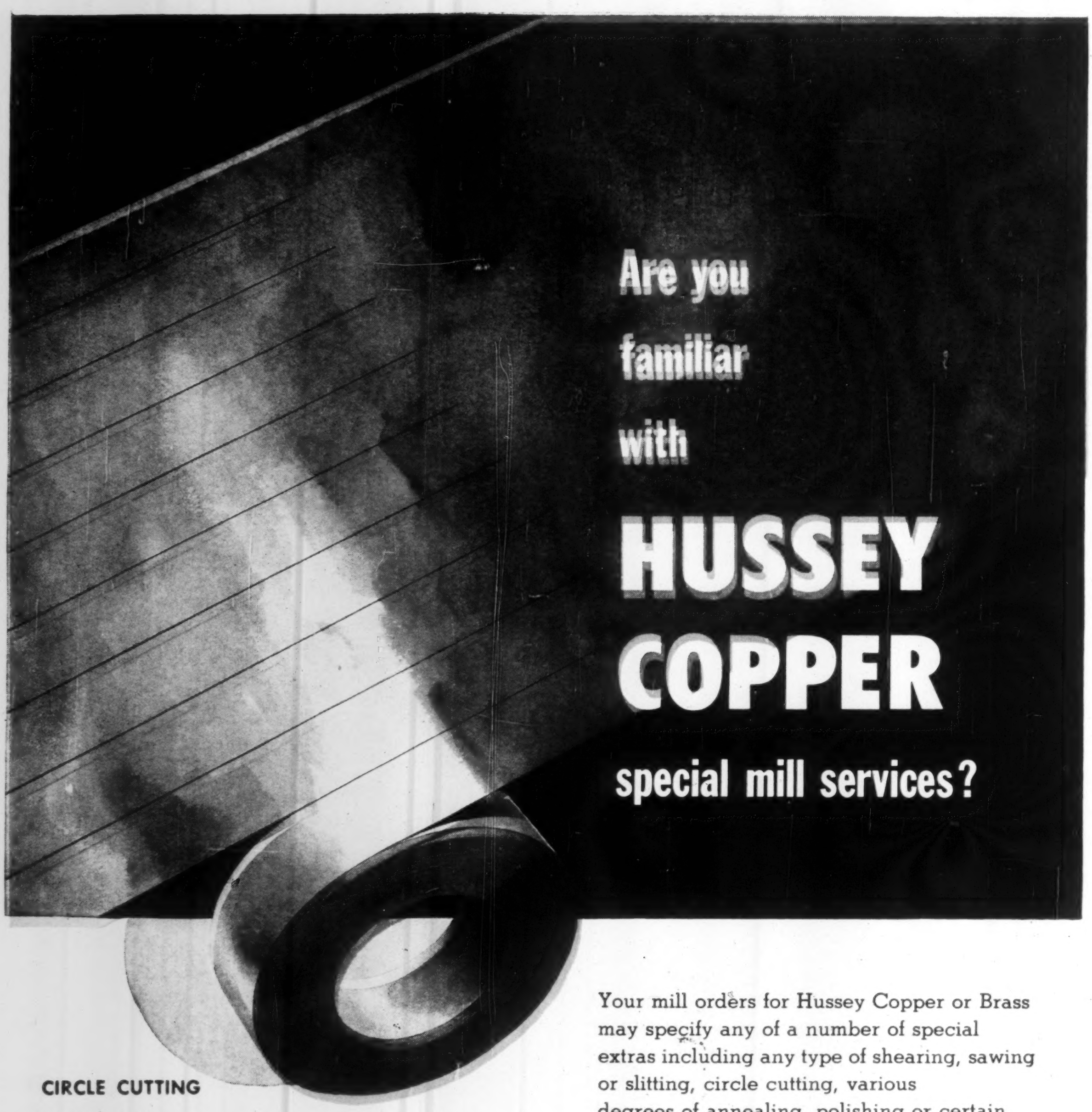


Standouts in Steam Trap Installations

W-S Forged Steel Fittings are a familiar sight around steam trap installations . . . especially when it's high pressure steam. Drop-forged from high strength steel, W-S Fittings readily resist stresses due to pressure, heat, shock and vibration. The W-S line includes 2000, 3000 and 6000 lb. fittings, 3000 lb. forged steel unions, stainless and alloy steel fittings and the new W-S Couplets for connecting to tanks and pipelines. Both screw-end and socket-welding fittings are available to meet your installation requirements. Ask for our new Forged Steel Fittings Catalog A-3.
Write to Dep't A, W-S Fittings Division,
H. K. Porter Company, Inc., P.O. Box 95, Roselle, N. J.



HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.



CIRCLE CUTTING
SLITTING
SHEARING
ANNEALING
POLISHING
SAWING

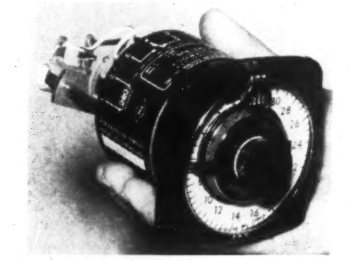
Your mill orders for Hussey Copper or Brass may specify any of a number of special extras including any type of shearing, sawing or slitting, circle cutting, various degrees of annealing, polishing or certain types of fabrication. Take advantage of Hussey Special Mill Services to reduce operations in your own production.

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh 19, Pa.

7 Convenient Warehouses to serve you

PITTSBURGH (19)	2850 Second Ave.
CLEVELAND (3)	5318 St. Clair Ave.
CINCINNATI (37)	1045 Meta Drive
CHICAGO (18)	3900 N. Elston Ave.
ST. LOUIS (1)	Central Terminal Bldg.
PHILADELPHIA (30)	1632 Fairmount Ave.
NEW YORK, LONG ISLAND CITY (6)	34-39 Thirty-first St.

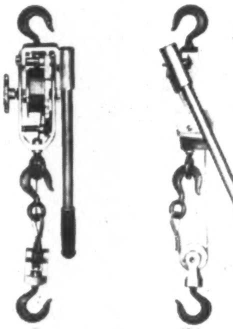
COPPER
HUSSEY
BRASS



Automatic Reset Timer . . .

. . . in new d-c model—*Automatic Temperature Control Co., Inc., Dept. HPAC,* 5200 *Pulaski Ave., Philadelphia* 44.

Designed for automatic emergency generator startup, motor startup, gas turbine installations, etc. D-c unit differs from company's a-c model only in clutch relay and motor, these being wound to accommodate voltage of particular application. Operating voltages ranging 6 to 250 volts, d-c, can be accommodated by unit, says company.



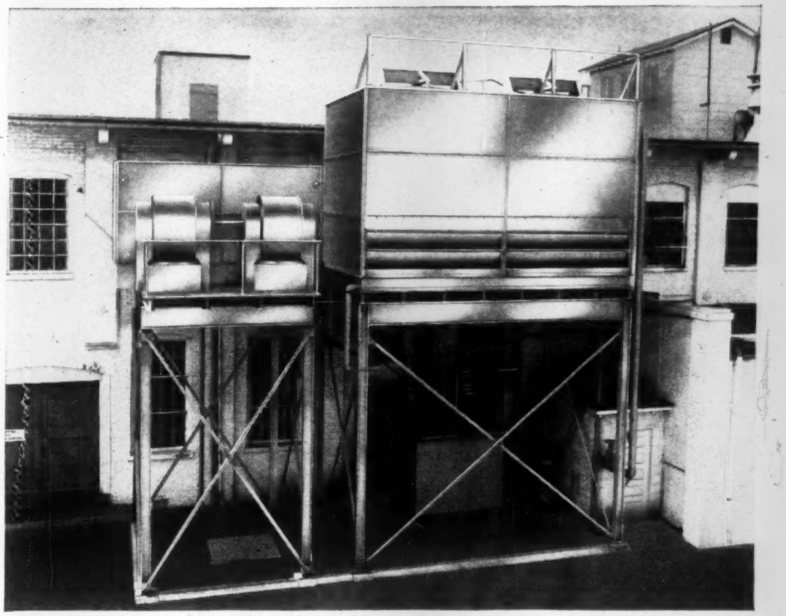
Portable Winch Hoist . . .

. . . with 2 ton capacity—*Aluminum Products, Inc., Dept. HPAC, Fort Lauderdale, Fla.*

Made of high tensile strength aluminum alloy castings, says company. Equipped with 25 ft of preformed wire rope, permits lift or pull of 12 ft double line or 25 ft single line. Designed to be easily carried or positioned by one man.

Bracket, Linkage . . .

. . . arrangement for butterfly valves —*W. S. Rockwell Co., Dept. HPAC,* 200 *Eliot St., Fairfield, Conn.*



Binks cooling towers—a youngster and an old-timer—work side by side at Vick Chemical Company, Greensboro, N. C. Tower at left was installed 17 years after tower at right which still serves faithfully.

Vick Chemical Company...

Supplements 1936 installation with second Binks cooling tower

17 years after their first Binks cooling tower installation, Vick Chemical needed additional cooling capacity. The dependable performance of their existing Type "K" mechanical draft tower was a decisive factor in selecting a second Binks cooling tower installation.

New Binks Series 3-B tower cross-connected with first tower

The new Binks Series 3-B cooling tower is used for condensing process steam. The old tower is presently used for the air conditioning system. Each installation is independent of the other but cross-connected so that each may stand by for the other in cases of emergency or during periods of maintenance.

Built-in long life

Case histories proving the dependable performance of Binks cooling towers are not uncommon. All parts are built to rigid specifications which insure long life. And, Binks cooling towers are designed for easy periodic maintenance, a factor appreciated by those who must do the work.

For full information

on Binks complete line of mechanical and natural draft cooling towers, write directly to the address below. Binks engineers will gladly study your needs and help you select the correct tower for your requirements.

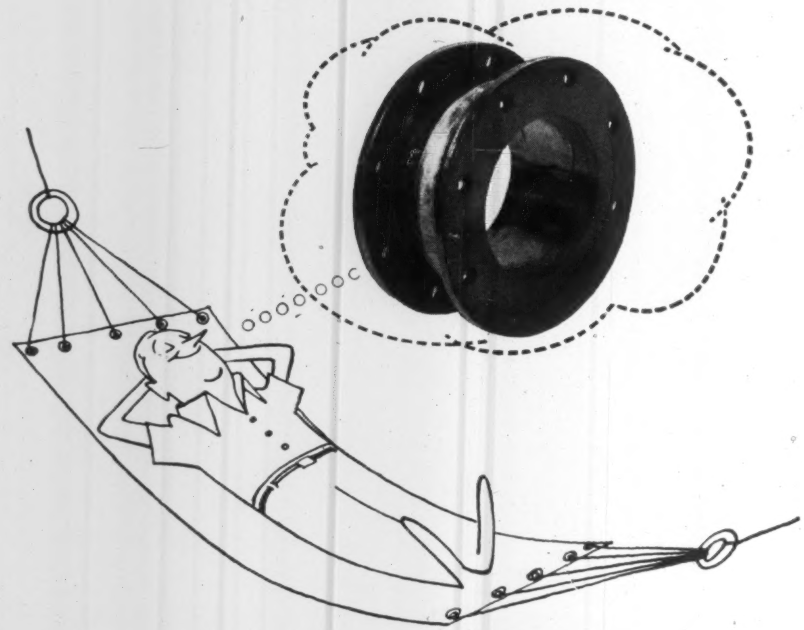
659

Binks
EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED ☎ DIRECTORY



YOU CAN REST ASSURED...

your piping is safe and silent with La Favorite Rubber Expansion Joints

If you are concerned with maintaining high production and low overhead, whether on land, or at sea, it is hardly necessary to remind you that vibration and thermal expansion in your piping system are a threat to both production and overhead.

La Favorite rubber expansion joints eliminate this threat quickly, safely, economically and silently.

- *Being of simple design with no moving parts, wear due to friction is ended.*
- *Being flexible and corrosion proof, they last longer than other types.*
- *Being of seamless construction and reinforced for strength, with natural gasket flange faces, leakage at expansion joints also becomes a thing of the past.*

La Favorite rubber expansion joints are made for all standard and special pipe diameters and flange dimensions for Chemical, Marine and Power Plant applications.

For a more complete story on La Favorite's "know-how in rubber" send for your copy of Bulletin 55. Additional personal service is as near to you as your telephone.

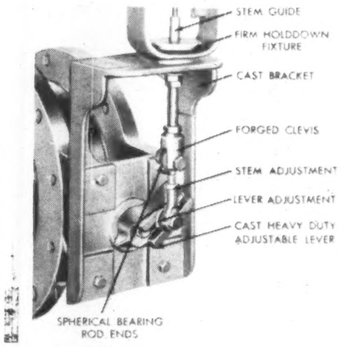
LA FAVORITE *Rubber Mfg. Co.*

256½ Wagaraw Road • Hawthorne, New Jersey

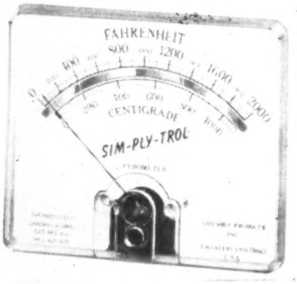
678

EQUIPMENT DEVELOPMENTS

Continued



Standard unit is said to simplify valves' hookup with automatic control operators, offer advantages in operation, adjustment, maintenance. Reduces power requirements in close control applications, says company. For butterfly valves to 48 in. pipe size, in accordance with required torque.



Indicating Pyrometers . . .

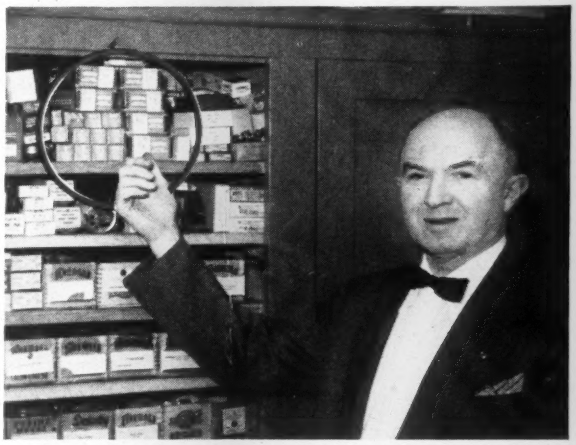
. . . redesigned with mirror scales to cut down parallex effect—*Assembly Products, Inc., Dept. HPAC, Chesterland, Ohio.*

Medium resistance units (4 ohms per millivolt) available in 21 standard ranges. Maximum sensitivity for unit connected to one thermocouple is 300 F deg for full scale deflection, says company. Ranges are −400 to 100 F up to zero to 3000 F. Styles available include panel mounting, portable, bench models.

Ceiling Diffusers . . .

. . . in new wide ring model with massive, flowing lines—*Air Control Products, Inc., Dept. HPAC, Coopersville, Mich.*

"they're easy and simple to take care of"


"Spare parts for a whole plantful take only a corner of a cabinet."

Q. Mr. Baker*, as Superintendent of Plant and Structures of the Newark Beth Israel Hospital, you've used a good many Yarway Impulse Steam Traps in the last 20 years. What, in your opinion, are their main advantages?

A. The big thing is that they're easy and simple to take care of. In many cases, they can replace traps much bigger and heavier. Then, too, they seldom give us any trouble. Usually we install 'em and forget 'em. When they do need service, replacement of the little valve is the worst that can happen, and that only takes a couple of minutes.

Q. What do your operating men think of Yarway traps?

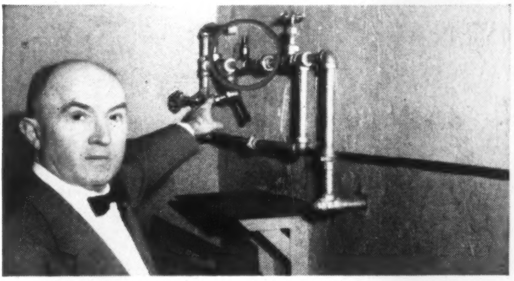
A. Twenty years ago, when the Yarway Impulse Trap was introduced as a new idea in steam traps, it made sense to me and I ordered some. My men, however, insisted they wouldn't work. I finally put on a demonstration on a steam leg down in the boiler room, and they were convinced. Now they are as enthusiastic as I am.

Q. How many Yarway Impulse Traps are installed around the plant?

A. I don't know exactly. They're all over the place. Certainly over 100. We have them throughout the laundry and kitchen, on all the steam tables and coffee urns in the cafeterias, in the operating rooms and Central Supply on sterilizers, autoclaves and stills, in the boiler room on fuel oil heaters, high and low pressure lines, and on steam line drips everywhere in the plant. To service all these, our inventory of spares and repair parts takes, as you can see, only a little corner in a filing cabinet.

Q. We notice a few traps of other makes around. How do you explain that?

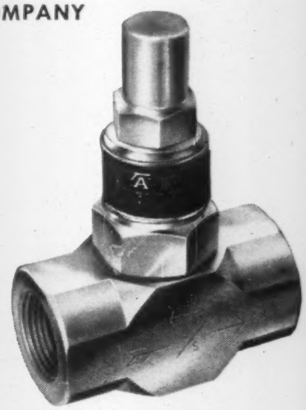
A. Well, some equipment gets installed with other traps on it—but first excuse we get, we replace 'em with Yarways!


"This Yarway Impulse Trap on drip line replaced a conventional trap that needed a platform to support it."

If you would like a copy of a new, helpful booklet, "The Why and How of Steam Trapping" drop a card to

YARNALL-WARING COMPANY
107 Mermaid Ave.,
Philadelphia 18, Pa.

**GEORGE E. BAKER,*
Supt. Plant and Structures,
Newark Beth Israel Hospital,
Newark, N. J.



YARWAY *impulse* ...a good way to specify steam traps

OVER 1,200,000 YARWAY IMPULSE STEAM TRAPS ALREADY USED • STOCKED AND SOLD BY 275 CONVENIENT LOCAL INDUSTRIAL DISTRIBUTORS • NATION-WIDE YARWAY ENGINEERING STAFF AVAILABLE FOR SERVICE.

In the fabulous Americana Hotel, Miami Beach

Architect, Morris Lapidus

J-E
SOLENOID VALVE
JACKES-EVANS MFG. CO.
ST. LOUIS
U.S.A.

J-E SOLENOID VALVES

Quietly and Dependably Control the Personalized Air Conditioning in 475 Guest Rooms

The nation's newest luxury hotel, The Americana, owned and operated by Tisch Hotels, Inc., has individually-controlled air conditioning, for heating or cooling, in every guest suite. Hill York Sales Corp., the air conditioning contractor, selected Jackes-Evans Solenoid Valves to assure quiet, dependable, personalized control of room temperatures.

J-E Solenoid Valves have a long and proven record in providing positive automatic temperature control for circulating chilled and/or hot water systems using fan-coil units in individual spaces of multiple room buildings. They quietly control flow of water without fluid shock or chatter—*dependably* respond to thermostat demands.

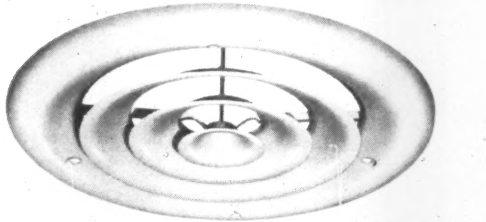
Unique J-E advantages include resilient synthetic diaphragm . . . no mechanical linkage or impact action to cause noise . . . tight seating with no bubble tolerance . . . simple design with only two moving parts . . . no metal to metal contacts to wear . . . flexible diaphragm that eliminates clogging.

Whatever your requirements, for a completely satisfactory job specify and use J-E Solenoid Valves. Call your wholesaler or write direct today.

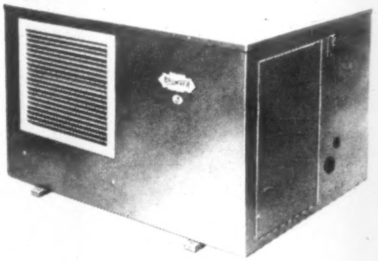
J-E

Controls Division
JACKES-EVANS MANUFACTURING COMPANY
4427 Geraldine Avenue • St. Louis 15, Missouri

-53



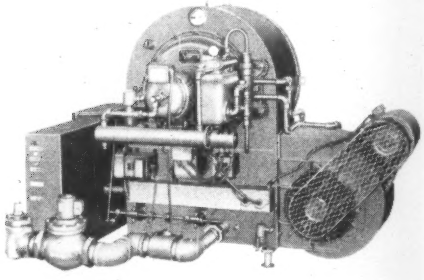
Designated "Model 76" in flush style, and "Model 77" in step-down version, unit consists of series of wide, concentric rings in new airfoil design, says company. Anti-smudge outer ring designed to eliminate turbulence-caused smudging. With "push-pull" rod operated damper with butterfly valve. In 6, 8, 10, 12, 14 in. sizes.



Outdoor Condensing Units . . .

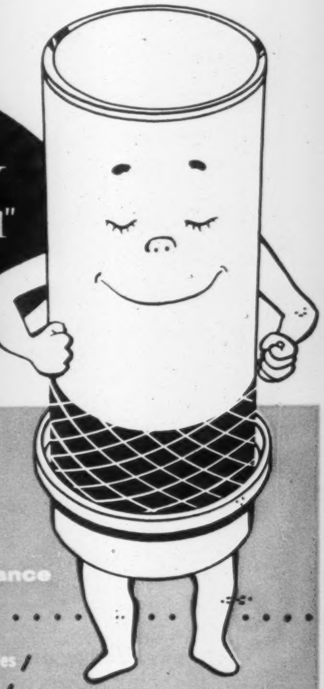
. . . in 2, 3 hp models—*Brunner Div., Dunham-Bush, Inc., Dept. HPAC, 28 Fisher St., Utica, N.Y.*

Weatherproof, high capacity, air cooled, semi-hermetic units recommended by company for commercial applications zero to 25 F and 20 to 25 F evaporator temperature ranges. Units specially designed for remote air conditioning applications also available, says manufacturer. Units designed to operate efficiently with 120 F ambient air across condenser.



Forced Draft Packaged Burner . . .

. . . designed to be combined with any type boiler for forced draft operation to form automatic "packaged boiler-burner unit," for high or low pressure steam



KOCH
JET forced draft
COOLING TOWER

An amazingly efficient tower that combines the simplicity of natural draft towers with all the efficiency of a forced draft tower.

- ✕ **no moving parts!**
- ✕ **installs easily . . . anywhere!**
- ✕ **compact . . . attractive!**
- ✕ **COST LESS!**

Available sizes match all self-contained air conditioners 3 to 25 tons

Meet Jetty a "real cool" guy!

Amazingly **simple design!**

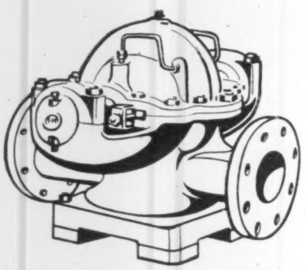
Simply **amazing performance**

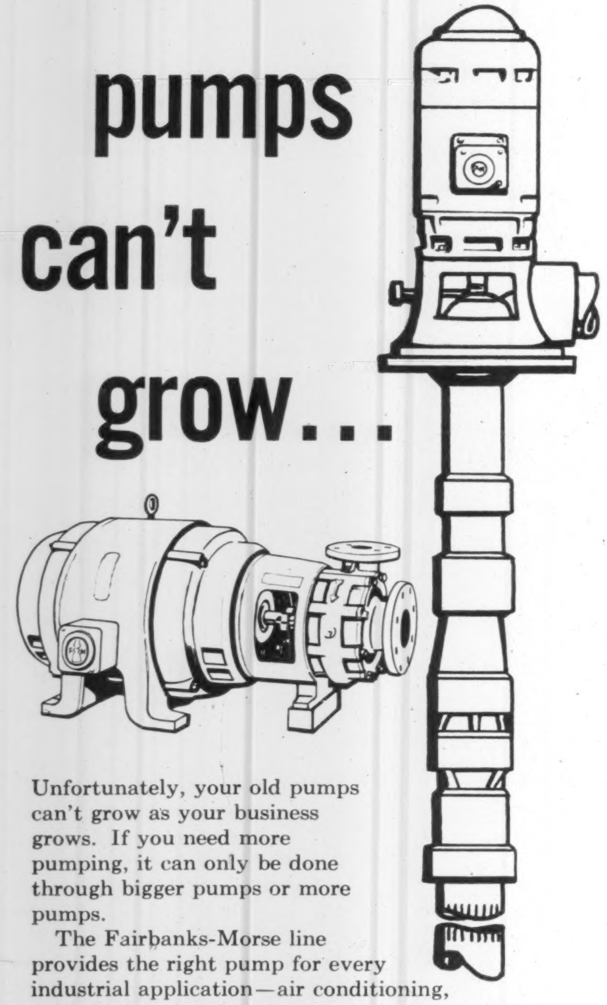
Inlet Diffuser / Inductor Nozzles / Powerful Jet Action Forces Air / 500 F P M Velocity / Assures Intimate Contact with Water / Self-Cleaning Dynamic Sprays / No Wood-Fill / 360° Glass Eliminator / Plasticlad Finish Top to Bottom /

The same engineering skill that has made Koch products outstanding in the basic oil industry equipment field has gone into the manufacturing of the revolutionary new Koch Jet Action Cooling Tower.

A few areas are open for Manufacturer's Representatives. Right now . . . write for information.

KOCH
ENGINEERING CO
321 West Douglas
Wichita, Kansas





Your pumps can't grow...

Unfortunately, your old pumps can't grow as your business grows. If you need more pumping, it can only be done through bigger pumps or more pumps.

The Fairbanks-Morse line provides the right pump for every industrial application—air conditioning, refrigeration, heating, transfer, booster service, casting washers, fire protection, coolant circulation and, of course, just plain industrial water supply.

Call your Fairbanks-Morse Field Engineer today, or write Fairbanks, Morse & Co., Dept. HPA-6, 600 So. Michigan Avenue, Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

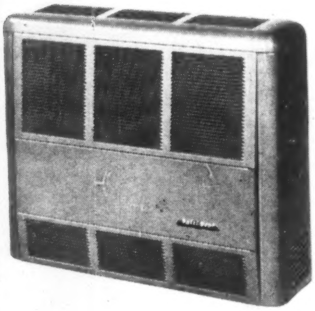
PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY
RAIL CARS • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

EQUIPMENT DEVELOPMENTS

Continued

or hot water heating—*Ray Oil Burner Co., Dept. HPAC*, 1301 *San Jose Ave., San Francisco* 12.

With maximum rated capacities 90 to 750 developed output hp. Burner specifications may be selected to burn any grade fuel oil, high or low pressure gas, or combination units burning either oil or gas, says company. Unit includes burner, belt-driven forced draft fan with speed adjustments, windbox with integral refractory, wired and enclosed control cabinet, ignition and electronic safeguard system.



Gas Wall Heater . . .

. . . for apartments, motels—*H. C. Little Burner Co., Inc., Dept. HPAC, San Rafael, Calif.*

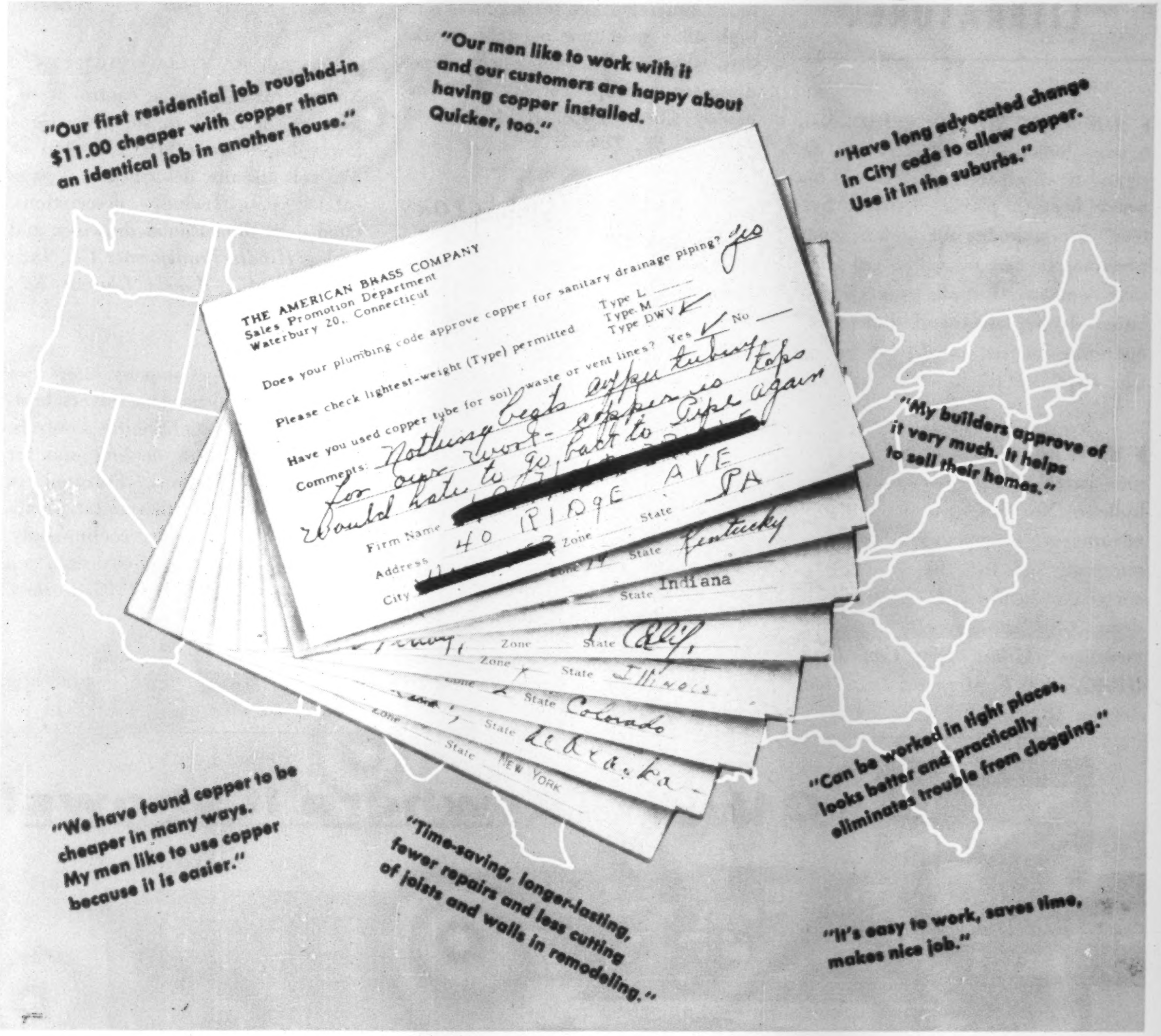
"Safti-Vent" available in new thin model designed to fit compactly under windows. Is said to be safe from room contamination resulting from combustion chamber sealed from room air. For through-the-wall installation. Rated 16,000 Btu. Operates on natural, mixed, manufactured, propane gases.

Suction Filters . . .

. . . for permanent installation in line sizes ½ to 1⅝ in. OD—*McIntire Co., Dept. HPAC, Livingstone, N.J.*

Utilize company's formed felt filter elements. Recommended by manufacturer for protection of refrigeration machinery. Five micron filter is said to hold back particles much smaller than will pass through regular 100 mesh screen. ✣

Poll Shows Swing to Copper for Drainage Systems



THE AMERICAN BRASS COMPANY
Sales Promotion Department
Waterbury 20, Connecticut

Does your plumbing code approve copper for sanitary drainage piping? yes

Please check lightest-weight (Type) permitted Type L ___ Type M ___ Type DWV ✓

Have you used copper tube for soil, waste or vent lines? Yes ✓ No ___

Comments: Nothing beats copper tubing for our work - copper is tops. Would hate to go back to Pipe again

Firm Name [redacted]

Address 40 RIDGE AVE [redacted] Zone State PA

City [redacted] Zone 14 State Kentucky

State Indiana

Zone State Calif.

Zone State Illinois

Zone 2 State Colorado

State Nebraska

State NEW YORK

"Our first residential job roughed-in $11.00 cheaper with copper than an identical job in another house."

"Our men like to work with it and our customers are happy about having copper installed. Quicker, too."

"Have long advocated change in City code to allow copper. Use it in the suburbs."

"My builders approve of it very much. It helps to sell their homes."

"Can be worked in tight places, looks better and practically eliminates trouble from clogging."

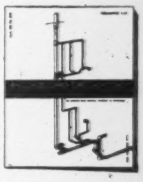
"We have found copper to be cheaper in many ways. My men like to use copper because it is easier."

"Time-saving, longer-lasting, fewer repairs and less cutting of joists and walls in remodeling."

"It's easy to work, saves time, makes nice job."

Hundreds of plumbers throughout the country were recently polled for their opinion of copper for drainage systems. The vote for copper was practically unanimous. A few of the returns are reproduced above and the quotes around them are representative of the other comments sent in.

Use copper on your next job and see why it saves time, is easier to install and makes a better job. For time and money-saving suggestions and detailed information on Anaconda Copper Tubes and Fittings for Sanitary Drainage Systems, send for Publication C-33. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



5703

ANACONDA® Copper Tubes and Fittings

Available through Plumbing Wholesalers

RECENT TRADE LITERATURE . . .

▶ *AIR CONTROL SYSTEM*—New 6 page bulletin describes system designed to eliminate air trouble in hot water heating plants. "Airtrol System" available for all boilers, compression tanks, regardless of size, says company. Bulletin covers installation details, sizes and dimensions, operating instructions. *Bell & Gossett Co., Dept. HPAC, Morton Grove, Ill.*

▶ *BARREL PUMP*—Controlled volume barrel pump covered in 2 page bulletin No. 1256. Literature cites advantages of pump in combined pumping and metering of toxic or corrosive chemicals from barrels or drums. Includes specifications, dimensions. *Milton Roy Co., Dept. HPAC,* 1300 *E. Mermaid Ln., Philadelphia* 18.

▶ *BRAZING RINGS*—Engineering data sheet No. 19 describes "Nicrobraz" brazing rings for stainless and high alloy steel tube assembly work. Covers features, advantages of rings; discusses their applications. *Wall Colmonoy Corp., Dept. HPAC,* 19345 *John R. St., Detroit* 3.

▶ *CENTRIFUGAL COLLECTORS*—Folder on centrifugal collectors describes two new design types, explains range of industrial applications for each in air cleaning and dust collection through centrifugal force. Specifications for 41 different sizes included, as well as dimensional drawings. *Kirk & Blum Mfg. Co., Dept. HPAC,* 3120 *Forrer St., Cincinnati* 9.

▶ *CHEMICAL FAUCET*—Stainless steel faucet designed for safe dispensing of flammable, corrosive fluids described in 2 page flyer. Literature contains cutaway and in-use photographs of unit, describes its advantages, method of operation, applications and design and construction features. *Economy Faucet Co., Dept. HPAC,* 12 *New York Ave., Newark.*

▶ *CONTROL TRANSFORMERS*—Normal reactance type control transformers, designed to supply various low voltages from 115, 230, 460 or 575 volt circuits, described in 4 page catalog 956. Includes descriptions, cited uses, dimensional drawings and tables. *Hindle Transformer Co., Inc., Dept. HPAC, Woods Church Rd., Flemington, N.J.*

▶ *CONTROLS*—Company offers two new 1957 catalogs. One covers heating and air conditioning controls, while other details cooling and air conditioning controls. Featured in both is "Rimset" thermostat, available for heating only, cooling only, or combination heating-cooling. *Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

▶ *COOLING TOWERS*—Line of "Flow-Mizer" cooling towers in ca-

QUALITY **where it shows!**

Stewart

REGISTERS and GRILLES

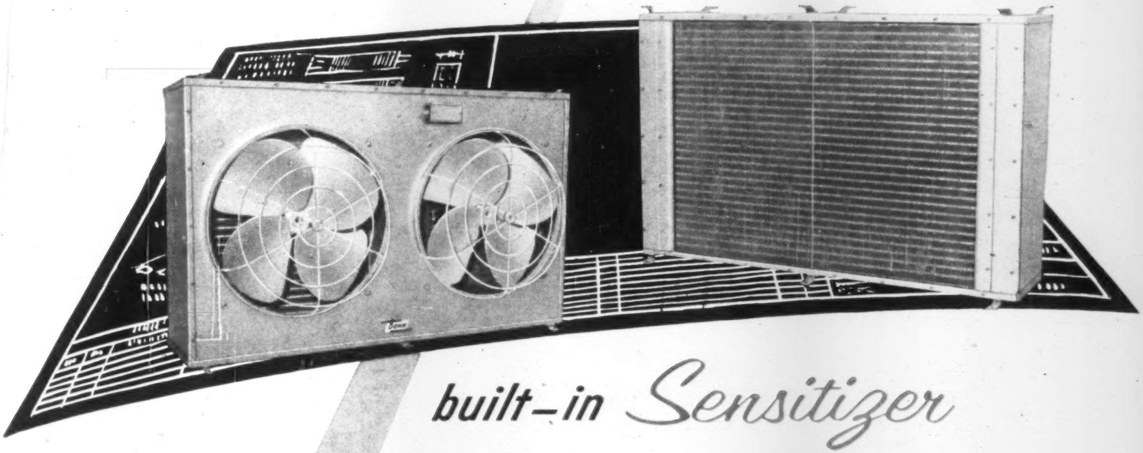
Registers must be functional, of course. But today's standards in decor require more than performance. Stainless steel trim calls for stainless steel accessories, wood paneling for bronze, aluminum must have aluminum for harmony.

Because Stewart has the know-how and artistry to produce in special metals, we can offer our standard directional-type outlets in all-stainless steel, all-bronze, all-aluminum, chromium plate, etcetera.

Our representatives, or home office, will be pleased to supply information for specific applications.

STEWART
manufacturing company, inc.
Cedar Grove, New Jersey

BOHN *Presents* the NEW ANGLE in Air-Cooled Condensers



built-in *Sensitizer* maintains proper head pressures

Reduces Cost and Simplifies Installation

BOHN engineers have developed a winter controlled air-cooled condenser equipped with built-in sensitizer to maintain head pressures when outside air temperature drops . . . eliminate hand valves in the control system . . . simplify piping.

Cost of extra valve and installation expense is avoided. Further cost reduction is achieved by designing for simple multiple circuiting.

Of finest quality, new BOHN air-cooled condensers are economically priced. They offer sturdy, rust-resistant construction in grained aluminum cabinet housing . . . trustworthy capacity ratings . . . famous Betz coils . . . fans which operate quietly . . . life lubricated ball bearing motors with thermal overload protection.

Read full details on the *NEW ANGLE* in air-cooled condensers. Reserve your free copy of the new BOHN CATALOG BU-1.

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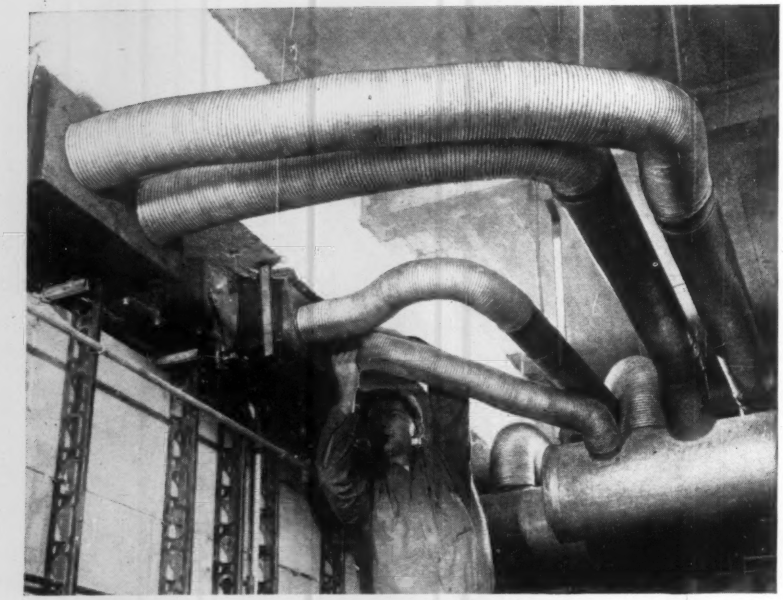
DANVILLE, ILLINOIS

Manufacturers of Commercial Refrigeration. Industrial Air Conditioning and Special Heat Transfer Surface

BOHN ALUMINUM & BRASS CORPORATION • BETZ DIVISION • DANVILLE, ILLINOIS



why you need Thermaflex®

for top performance and time and money savings

What is Thermaflex?
An extremely lightweight, flexible ducting made of a spring steel wire helix covered with a three-ply laminate of woven fiber glass and metallic sheeting.

What are its applications?
Thermaflex is designed to supply air at temperatures ranging from 0°F. to 250°F. It is mainly used as a connector between main lines and diffusers or sound boxes in high and low pressure air-conditioning systems.

Is it flame resistant?
Thermaflex will stand 1200°F.* without any sign of combustion or melting. The covering used in its construction is approved by Underwriters' Laboratories, Inc.

What about installation?
It installs faster than rigid ducting at *savings up to 32%*. One man can do the job without special tools, fittings or elbows in just a few minutes.

What pressures will Thermaflex handle?
25 psi, which is 5 times the minimum standards of the New York Board of Standards and Appeals.

How flexible is Thermaflex?
It takes tight bends with a radius equal to half its own diameter with practically no decrease in cross-sectional area.

How long will it last in service?
Much longer than rigid metal ducting. It is impervious to moisture, rust, rot, fungus and mildew.

How is Thermaflex sold?
In a wide variety of diameters in standard 12-foot lengths that can be easily spliced or cut for long or short runs.

How can I make sure that Thermaflex will solve my problems?
Write to Dept. 76 for more information. Our engineers will be glad to put their experience to work for you.

***As approved by the New York Board of Standards and Appeals.**

Flexible Tubing
CORPORATION
GUILFORD, CONNECTICUT • LOS ANGELES 64, CALIFORNIA

RECENT TRADE LITERATURE

Continued

pacities 20 to 175 tons covered in 8 page catalog No. 361. Capacity selection data presented in tabular form. Includes graphic data on pump and nozzle performance, engineering specifications, elevation drawings, dimension tables. *Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

▶ *DUCT SYSTEM*—"Ceramiduct" heating duct material for radial and perimeter heating described, illustrated in 8 page brochure. Literature includes specifications, design information, instructions for laying and jointing. Manufactured by *Straitsville Brick Co., New Straitsville, Ohio.* Copies available from *Harry O. Donnelly Co., Dept. HPAC, 34 Frank Blvd., P.O. Box 5285, Akron 13, Ohio.*

▶ *DUST CONTROL*—Four-company report on *How to Control Dust and Save Money in the Manufacture of Building Materials* illustrates how manufacturers have used cloth-tube type dust collectors to save cost through product recovery, improved quality control, increased productivity of workers. *Wheelabrator Corp., Dept. HPAC, Mishawaka, Ind.*

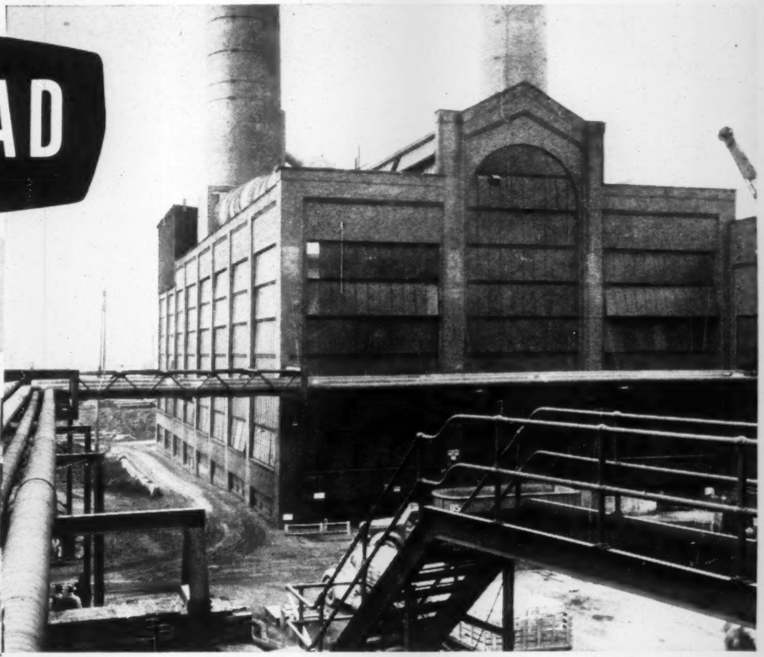
▶ *ELECTRIC THERMOSTAT*—Bulletin RT-804 contains diagrams, information concerning installation and application of "Model E1" electric thermostat for use in refrigerating, ventilating, alarm systems. Unit available in temperature ranges to 800 F. *Robertshaw-Fulton Controls Co., Dept. HPAC, 110 E. Otterman St., Greensburg, Pa.*

▶ *ELECTROMAGNETIC CONTROLS*—Company has issued seven new electromagnetic control catalogs. By number, these are: 57-S1, automatic transfer switches; 57-S2, remote control switches; 57-S3, magnetically held contactors; 57-S4, relays; 57-S5, a-c and d-c solenoids; 57-S6, electric plant controls; 57-S, complete control catalog. *Automatic*

OVERHEAD

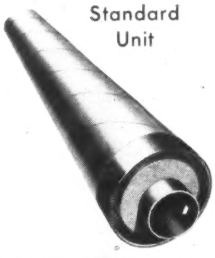
OR

underground



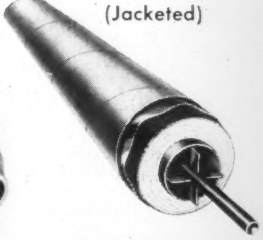
RIC-WIL offers the COMPLETE quality line of prefabricated piping systems

Ric-wiL factory prefabricated piping systems, *timed* to your schedule and *shipped* directly to the job site, can save you valuable time and money. Insulated units are available for steam, hot water, oil, other viscous fluids, process liquids and refrigeration lines . . . and remember . . . Ric-wiL is the quality system of exceptionally high mechanical strength and thermal efficiency.

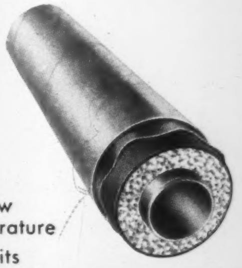


Standard Unit

Type UL



Type J (Jacketed)



Low Temperature Units

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

RIC-WIL INCORPORATED

PREFABRICATED **INSULATED PIPING SYSTEMS**

BARBERTON, OHIO

IN CANADA: THE RIC-WIL COMPANY OF CANADA LIMITED

Write for a copy of the new RIC-WIL Catalog . . .

DART
"Note the True Ball Joint ...that's a DART Exclusive"

Yes, Dart Unions fit tighter and last longer because their two bronze seats are precision ground to a true ball joint. You get a drop-tight connection without straining arm, wrench or union. What's more, a Dart uncouples just as easily. Ask your supplier.

QUICK FACTS

- Extra wide bronze seats resist pitting and corrosion.
- Nut and body of air-refined, high test malleable iron are practically unbreakable
- Heavy shoulders can withstand the toughest wrench abuse
- Each Dart is individually vacuum-tested

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AVAILABLE THROUGH YOUR LOCAL DISTRIBUTOR

RECENT TRADE LITERATURE

Continued

Switch Co., Dept. HPAC, Florham Park, N.J.

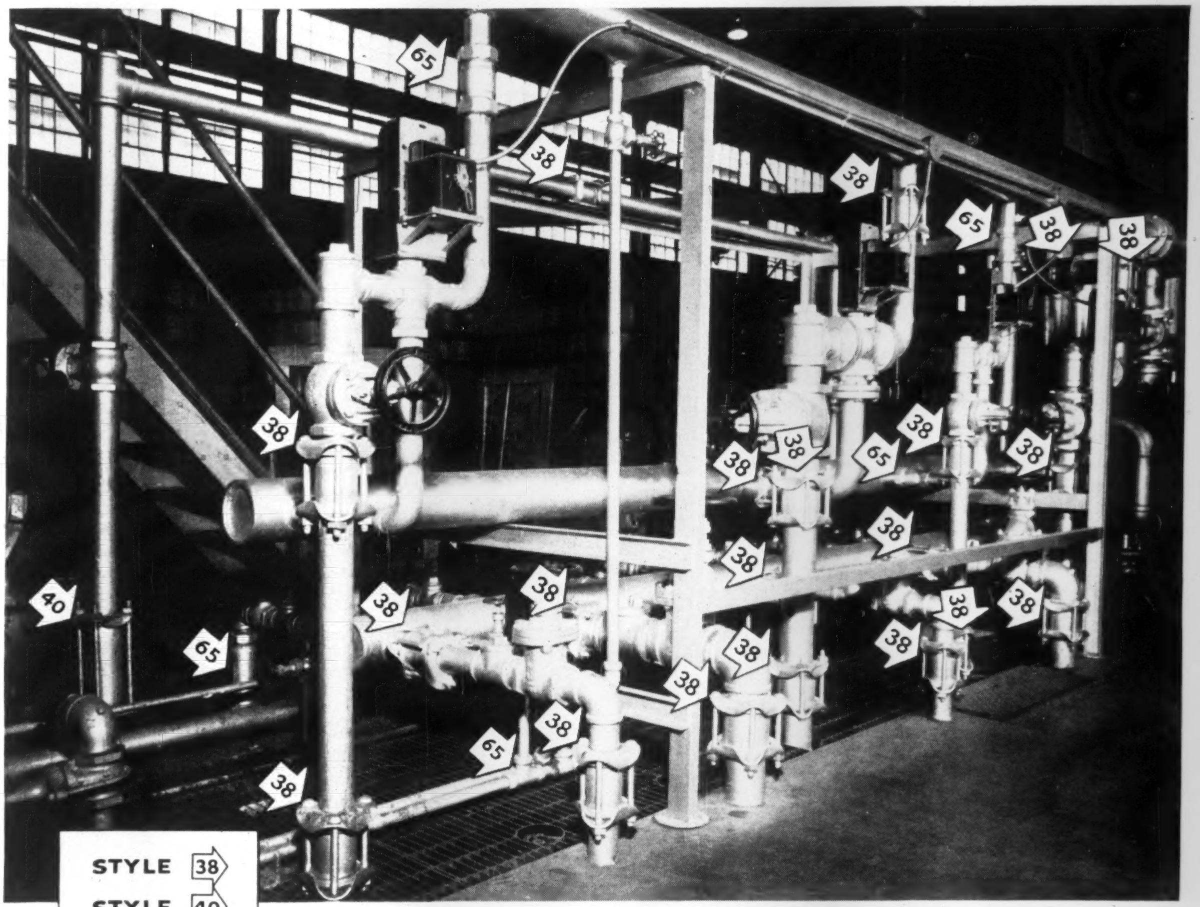
▶ *FILTER-DRIER*—New 12 page bulletin No. 40-10 covers application, installation, capacities, specifications for "Catch-All" filter-drier. Gives facts about decomposition of refrigerant oils, acids in refrigeration system. *Sporlan Valve Co., Dept. HPAC, 7525 Sussex Ave., St. Louis 17.*

▶ *GASKETS, PACKINGS*—New 48 page catalog contains information on industrial gaskets, mechanical packings, boiler gaskets, packing hooks, other products. Engineering section includes gasket recommendation chart, material comparative cost graph, gasket fault elimination chart, mechanical formulas, decimal equivalents table. *Rhopac, Inc., Dept. HPAC, 3425 Cleveland St., Skokie, Ill.*

▶ *HEATING*—New 8 page form No. 5627 describes "SelecTemp" heating system. Cited feature of system is modulated thermostatic control of temperature in every room. *Iron Fireman Mfg. Co., Dept. HPAC, 3170 W. 106th St., Cleveland 11.*

▶ *INDUCED DRAFT FANS*—New 4 page bulletin No. SI-102 illustrates, describes "Spid" induced draft fans designed to eliminate tall stacks, require minimum maintenance, operate quietly, install quickly. Includes construction features, installation suggestions, sample specifications, dimensions. *Chicago Blower Corp., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

▶ *METERS*—Industrial metering bulletin 566 revised to help user select best meter-register combination for industrial liquid metering job. Arranged in chart form, subjects covered include: how meters save; list of liquids that can be handled;



This picture shows you
26 Ways to Save Time, Labor and Money!

Every Dresser Coupling and Compression Fitting is a way to save money — no threading, no exact pipe fitting, no welding, no grooving, no caulking. (And there are 26 of these money savers in this piping setup alone.)

Take those five Style 65 Dresser Compression Fittings, for instance. You simply stab *plain pipe ends* into the fittings and tighten the end nuts. Time: about 30 seconds per joint!

Or take the twenty Style 38 Dresser Couplings (and one Style 40). They're wrench-installed in only two man-minutes per bolt!

For a full range of sizes and shapes . . . save time, save money . . . see your nearest piping supplier.

DRESSER®

Dresser Manufacturing Division, 79 Fisher Ave., Bradford, Pa.
In Canada: Toronto and Calgary.

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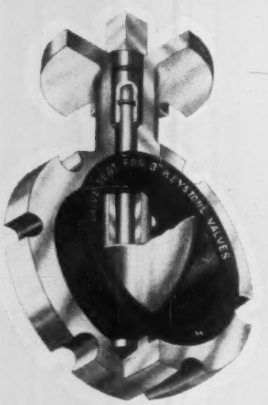


QUICK ACTING
POSITIVE SEAL
LIGHT WEIGHT
LOW COST

KEYSTONE
Valves

are the answer to the increasing demand for a valve **positive** in its function under any condition and where space and weight saving is a factor.

PRESSURE RATING—Keystone Standard Valves 1" through 20" rated 150 p.s.i.; valves 24" through 48" rated 125 p.s.i.

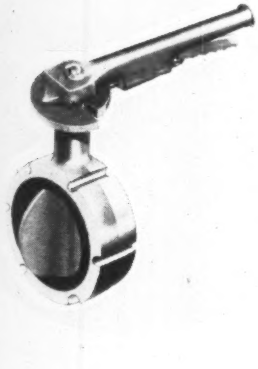
KEYSTONE Valves shut off completely against low pressure or vacuum or full rated line pressure. They are recommended for use on pressure or vacuum lines handling liquids, gases, dry materials and slurries. Other proven applications are acetylene, air, acids, alcohol, alkalis, ammonia, bromine, beer, catalyst, condensate, cement (dry or slurry), low pressure steam, paper stock, river water, sea water, vacuum dust and vapor accumulations, edible oils, hydrocarbon gases, lube oil, gasoline, cooling water for condensers and turbines, salt water disposal systems, soap, latex, molasses, and many other services too numerous to mention.

LOW MAINTENANCE — the seat can be changed on the job site in a few minutes with the use of simple hand tools. It is not necessary to grind, lap, or do other machine work to replace a **KEYSTONE Valve** seat.

Write for complete information. KEYSTONE specialists with valve "know-how" can help with your flow control problems.

KEYSTONE VALVE CORP.
P. O. BOX 6716
5325 KIRBY DRIVE HOUSTON 5, TEXAS

REPRESENTATIVES IN VARIOUS CITIES THROUGHOUT THE WORLD



RECENT TRADE LITERATURE

Continued

construction details; register types; sizes of meters. *Neptune Meter Co., Dept. HPAC, 19 W. 50th St., New York 20.*

▶ *PACKAGED INDUSTRIAL HUMIDIFIERS*—Two page bulletin No. 91 covers "Herrmidifier" packaged industrial humidifiers, designed to regulate humidity automatically, reduce shrinkage and waste, control static electricity, improve plant atmosphere. Includes table of recommended humidities, temperatures for various industries. *Herrmidifier Co., Dept. HPAC, Neffsville, Pa.*

▶ *PIPE*—Design, construction, typical applications of "Fluoroflex-T" pipe described in 4 page bulletin. Processed from Teflon resin and glass fiber, pipe is said to be chemically inert, fractureproof. Bulletin lists specifications for standard "R6000" pipe; includes drawings, specifications showing how pipe can be incorporated into existing piping systems. *Resistoflex Corp., Dept. HPAC, Roseland, N.J.*

▶ *PIPE INSULATION*—*Pipe Insulation News* is 4 page quarterly carrying articles dealing with problems of insulating underground hot pipes. Discusses uses of "Gilsulate" insulation. *American Gilsonite Co., Dept. HPAC, 134 W. Broadway, Salt Lake City 1.*

▶ *PIPING*—*How Piping is Fabricated* is title of new 16 page brochure. Literature illustrates company's equipment, materials and processes, services. *Flori Pipe Co., Dept. HPAC, 601 E. Red Bud, St. Louis.*

▶ *PUMPS*—Designed to aid selection of right corrosion resistant pump for applications to 350 gpm, 20 page manual CE-55 presents comparative data for four types of pumps. Molded hard rubber centrifugal pumps, rubber lined centrifugal pumps, "Ace Jabsco" (neoprene impeller) pumps,

What delivers this magazine...

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Postage and mailing names are both pretty easy to come by. But it takes more . . . MUCH more . . . to get a magazine *read.*

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Heating, Piping & Air Conditioning

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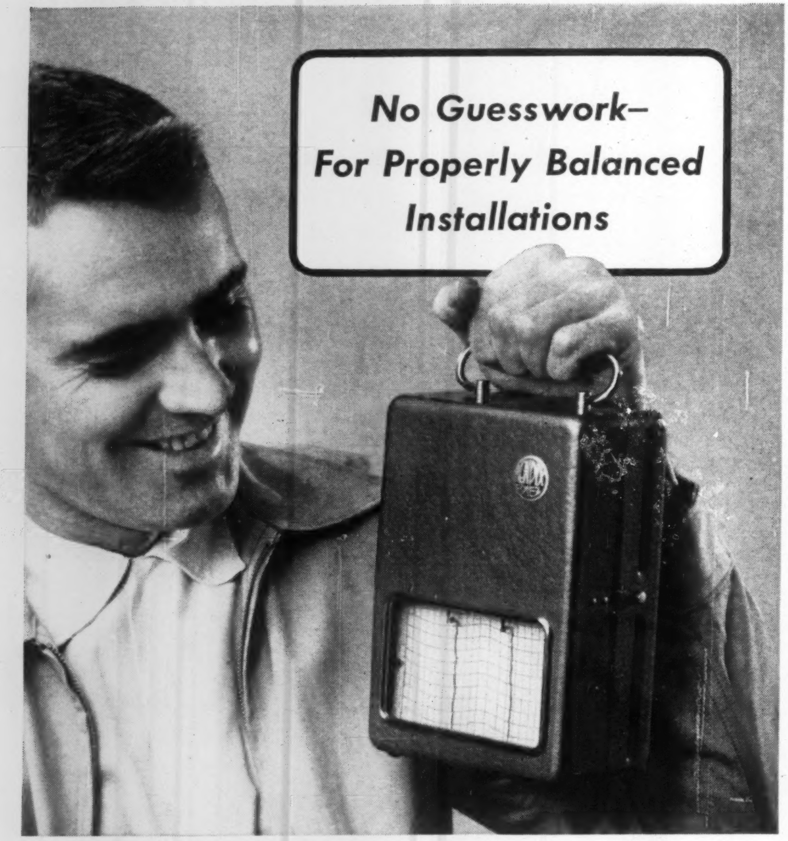

PORTABLE TEMPERATURE-HUMIDITY RECORDER HELPS YOU SELL, SERVICE AND INSTALL!

There's no need to gamble when you can be sure. The Bendix-Friez* Portable Temperature and Humidity Recorder has taken the gamble out of air conditioning and refrigeration installations. It gives you a permanent record of all temperature and humidity fluctuations on a single chart. You don't have to estimate the problem—you can *know* exactly what conditions you are dealing with before any installation is begun. In addition, it proves the operating efficiency of your equipment after it is installed.

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Completely automatic, the Recorder does not need wet bulbs, wicks or psychrometric tables and is built for 10-hour or 30-hour continuous operation. Write for our brochure "Bendix Tools for Heating, Refrigeration and Air Conditioning". Address 1494 Taylor Avenue, Baltimore 4, Maryland.

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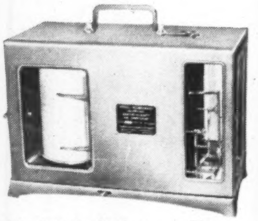

The Bendix-Friez Hygro-Thermograph (above), for more permanent installations, is a superior temperature and humidity monitor, built to U. S. Weather Bureau standards.

Friez Instrument Division

Bendix
AVIATION CORPORATION

gear pumps included. Capacity charts, specification data assist in selection. *American Hard Rubber Co., Dept. HPAC, 93 Worth St., New York* 13.

▶ *PVC VALVES, FITTINGS*—Line of polyvinyl chloride valves and fittings described, illustrated in 16 page bulletin. Literature presents 4 pages of application tables on performance of normal and high impact types designed for handling about 315 different fluids that attack other materials. *Walworth Co., Dept. HPAC, 60 E. 42nd St., New York.*

▶ *RADIATION*—Finned radiation and enclosures for commercial, industrial uses covered in 20 page catalog FT-55. Describes 15 basic heating elements and "F" sloping top, "E" flat top, "Sil-Vector" and "Sil-N-Wall" enclosures. *Rittling Corp., Dept. HPAC, Rittling Bldg., Buffalo.*

▶ *RECIRCULATING COOLING WATER SYSTEMS*—Technical paper No. 134, *Biological Fouling in Recirculating Cooling Water Systems*, describes common problems of slime and algae in systems, points out how deposits of biological origin can interfere with heat transfer. Discussion of control agents, selection of proper toxicant included. *Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia.*

▶ *REFRIGERATION PRODUCTS*—New bulletins, by number, cover the following: G-11A, tube clamps, mounting brackets, strap hangers, van hangers; G-15, liquid indicators (sizes through $\frac{5}{8}$ in.); G-17, driers (cartridge type shells 1 to 120 ton capacity); G-18, filter-driers (1/6 hp to 10 ton capacity). *McIntire Co., Dept. HPAC, Livingston, N.J.*

▶ *REFRIGERATION VALVES*—New 16 page form W-4-S, section M, is condensed refrigeration valve

A New Approach to Perfection

MAINTENANCE-FREE LIMA MOTORS IN ALL NEW NEMA FRAME SIZES

- 30% LESS WEIGHT PER HORSEPOWER
- 30% VOLUMETRIC SIZE REDUCTION
- DUAL FANS INTEGRALLY CAST WITH ROTOR
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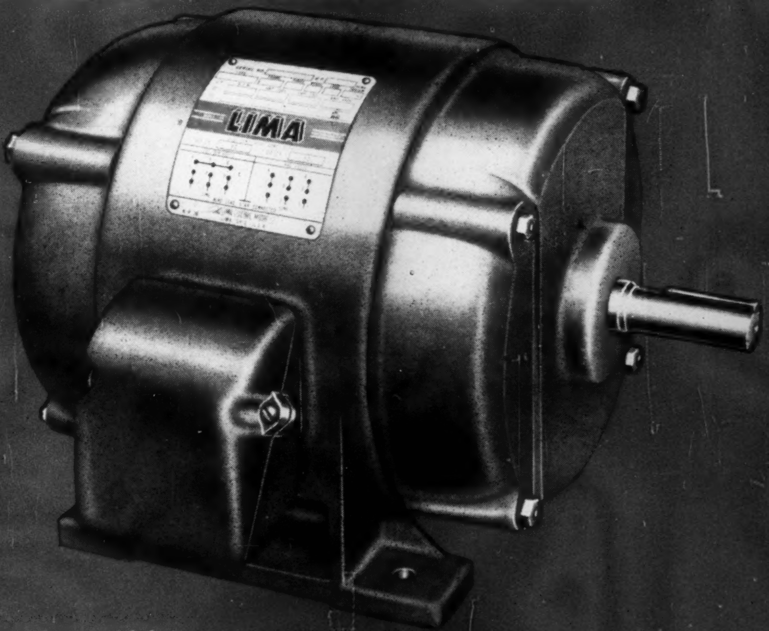
- RIGID, CAST IRON FRAMES WITH INTEGRALLY CAST FEET
- DIAGONALLY SPLIT CAST ALUMINUM CONNECTION BOXES— CADMIUM PLATED COVER SCREWS
- TOTALLY ENCLOSED FRAMES MEET J.I.C. SPECIFICATIONS



Slash maintenance costs and eliminate costly inspection and lubrication programs with Lima Motors in NEW NEMA frame sizes. With lubricated-for-life DOUBLE-WIDTH ball bearings, solid die cast aluminum rotors with dual integral fans, and Mylar insulation . . . Lima gives you higher full-load speeds with the most complete motor protection available. Install these new Finest Quality Lima Motors—and forget them.

Lima now has in production all ratings in new NEMA frame sizes 182 through 326U. Get complete details on Lima's new NEMA *maintenance-free* motors from your Lima Representative now! If he is not already calling on you, his name and address will be found in *Thomas' Register, MacRae's Blue Book* or *Conover-Mast Purchasing Directory.*

Of course, Lima will continue to produce regular NEMA frame sizes 66 to 505 (1/3 to 150 H.P.), incorporating the latest advances in motor design.

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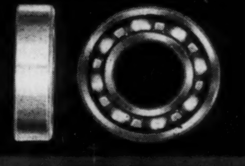
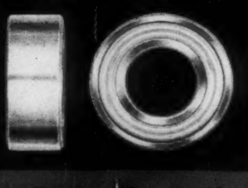


THE OLD WAY

Open and unprotected motor bearings subject to contamination and must be inspected and lubricated frequently.

DOUBLE-WIDTH FULLY PROTECTED



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Sealed and protected—Lima's DOUBLE-WIDTH pre-lubricated motor bearings require no attention—just put the motor to work and forget it.

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FIRST . . . FOR MOTORS . . . DRIVES . . . SPEED REDUCERS

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ONE CHECK VALVE
for any and all requirements

This DURABLA check valve unit, added to any standard fitting (such as the reducing coupling shown above) gives you a complete check valve *suitable for ANY service.* With a few of these units in stock you are prepared for any emergency.

Because DURABLA check valves will operate in any position, they can be installed without changing existing lines. Made of stainless steel, they will handle practically any liquid, gas or air—at all temperatures and pressures.

DURABLA check valves are available in seven standard line sizes, from 3/8" to 2". Ask your distributor for complete information or write us direct.

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DURABLA MANUFACTURING COMPANY
114 LIBERTY STREET • NEW YORK 6, N. Y.

RECENT TRADE LITERATURE

Continued

catalog illustrating, describing company's standard and special type valves, filters, driers. Contains new capacity ratings, new data on improvements in designs. *A-P Controls Div., Controls Co. of America, Dept. HPAC, 2450 N. 32nd St., Milwaukee.*

▶ *REGULATORS*—Line of high pressure gas regulators described in 8 page bulletin No. 1024-6. Feature of revised bulletin is page of description, illustrations of recently introduced high pressure "141" regulator, designed to withstand momentary overloads as high as 1000 psi on outlet side. *Meter and Valve Div., Rockwell Mfg. Co., Dept. HPAC, 400 N. Lexington Ave., Pittsburgh 8.*

▶ *SEAMLESS, WELDED PIPE*—Data folder on steel piping contains two tables. One table lists dimensional data for 16 sizes 1/8 to 8 in. nominal size for six different weight schedules showing OD, ID, wall thickness, weights per foot. Other table covers ASTM and ASME specifications, showing title, grade, type, analysis for various carbon, alloy, stainless steel pipe used for high temperature, high pressure, other services. *Tubular Products Div., Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

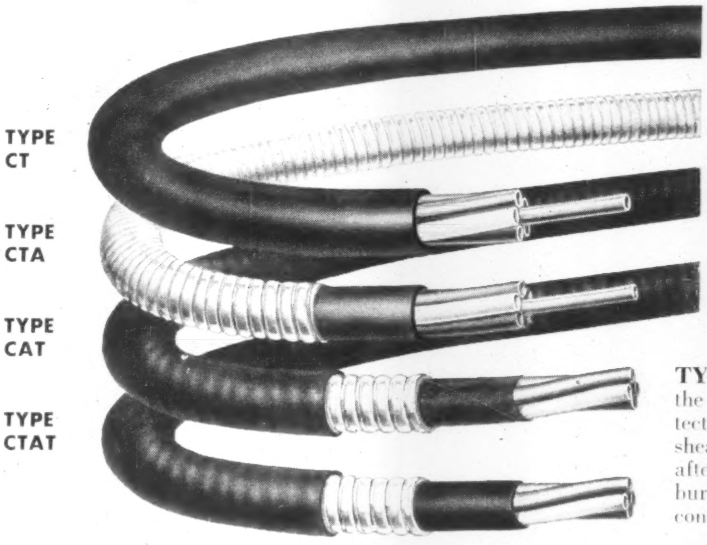
▶ *STEAM, LIQUID CONTROL VALVES*—Condensed catalog No. 57 describes over 50 products in company's line. Covered are pressure, temperature regulators; solenoid, diaphragm, motorized, float valves; pressure reducing, flow control, safety, relief valves; strainers. *O. C. Keckley Co., Dept. HPAC, 3402 Cleveland St., Skokie, Ill.*

▶ *STEAM PURITY*—Technical paper No. 135, *Conductivity Versus Sodium by Flame Spectrophotometer in Steam-Purity Studies,* presents results of laboratory and plant work to indicate that sodium is valuable in evaluating steam purity. *Betz Lab-*

The Answer To Your Corrosion Problems

CRESCENT ARMORED MULTITUBE*

FOUR CORROSION-RESISTANT TYPES



TYPE CT—In damp or corrosive locations where a moderate degree of mechanical protection to the tubes is required, as in troughs or attached to sheltered building surfaces as supporting means, the first construction illustrated is recommended. It employs a tough, corrosion-resistant polyvinyl chloride thermoplastic sheath, resistant to water, acids, alkalies, oils and most chemicals, applied over CABLED copper* tubes. The sheath will not support combustion.

TYPE CTA—gives corrosion protection to the tube, and the galvanized steel armor protects the tubes and polyvinyl thermoplastic sheath from mechanical injury during and after installation. Recommended for direct burial in concrete or pulling into underground conduits.

TYPE CAT gives corrosion protection to the galvanized steel armor as well as the tubing. Recommended where the polyvinyl thermoplastic sheath will not be subject to mechanical injury.

TYPE CTAT—Combining the advantages of Types CTA and CAT, the fourth type illustrated has the polyvinyl chloride thermoplastic sheath both under the armor and over the armor, thus providing maximum mechanical and corrosion protection.

** All these corrosion-resistant types can be furnished with aluminum, steel or polyethylene tubing, and up to 37 tubes.*

CRESCENT
PLASTIC COATED SINGLE TUBE
CORROSION RESISTANT INSTRUMENT TUBING

Plastic Coated Single Tubes, copper or aluminum, should be used to give corrosion protection to all single lines up to the final tube fitting, where trouble from corrosion may occur.

Send for Bulletin 356-I giving complete information and engineering data

CRESCENT INSULATED WIRE & CABLE CO.

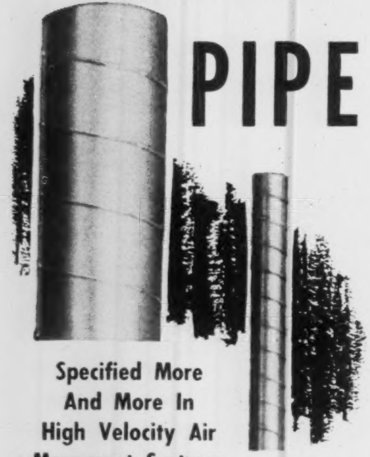
TRENTON, NEW JERSEY

*Reg. Trade Mark

SPIRAL

Lockseam

PIPE



Specified More And More In High Velocity Air Movement Systems

Rigidly constructed Spiral "Lockseam" Pipe by United Sheet Metal Co. is fast replacing longitudinal-seam pipe in high velocity systems. Seams are locked by a strong 4 ply lockseam . . . pipe interiors are smooth. Rigidity derived from this unique construction results in greater strength, faster installation and reduced job-site costs.

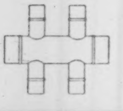
Sizes And Standards For High Velocity Air—

• 26 gage zinc-coated steel—diameters 3" through 8" • 24 gage steel—9" through 22" • Standard length 12' —lengths to 20' if required • Available in any specified metal 20 to 30 gage.

PROVEN IN OPERATION

United's Spiral "Lockseam" Pipe has been specified and recently installed in over 400 major building projects . . . including hospitals, mines, government, university and commercial buildings, and churches.

Write For Free Catalogue Showing Detailed Specifications And Applications



MATCHED FITTINGS AVAILABLE FOR EVERY SPIRAL PIPE DIAMETER

UNITED

Sheet Metal Co.

543 S. Drexel Ave., Columbus 9, Ohio

RECENT TRADE LITERATURE

Continued

oratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia.

▶ *STEAM TRACED PIPE*—Six page folder describes "Unitrace" which combines piping, steam tracing in one unit. Covers four new sizes, new shape. Contains specification tables, charts for determining support spacing. *Aluminum Co. of America, Dept. HPAC, 790 Alcoa Bldg., Pittsburgh 19.*

▶ *STEAM TRAPS*—Bulletin No. 154 is condensed buying guide for company's line of "Super-Silvertop" steam traps. Contains specifications, capacities, sizes, pressures, weights, list prices for all principle types. Construction, operation of units described. *V. D. Anderson Co., Div. of International Basic Economy Corp., Dept. HPAC, 1935 E. 96th St., Cleveland 2.*

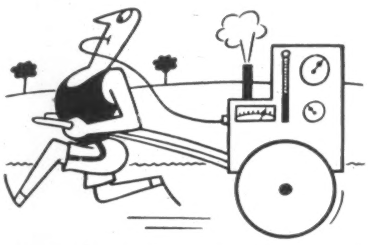
▶ *STEAM TRAPS*—Bulletin T-1746 describes "Yarway Series 40" impulse steam trap designed to handle heavy condensate loads. Covers operation, gives sizes and capacities, lists typical applications, shows dimensions and weights. *Yarnall-Waring Co., Dept. HPAC, Chestnut Hill, Philadelphia 18.*

▶ *TANK HEATERS*—Engineering bulletin designed to aid in selection of proper "Hydro-Flo" tank heater or tank-and-heater combination. Designed to help solve heating engineering problems, bulletin combines temperature factor table with capacity curves and list of dimensions, surface areas, tables of ratings for tank heaters. *Bell & Gossett Co., Dept. HPAC, Morton Grove, Ill.*

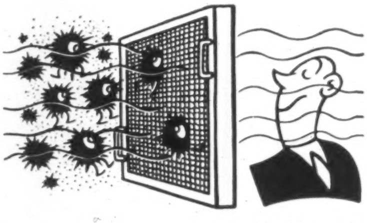
▶ *TEMPERATURE CONTROLS*—Four page bulletin F-2287-4 discusses application of "Electrionic" temperature controls for heating, ventilating, air conditioning. Explains features, functions, advantages. Components, accessories used in various systems

AIR-MAZING FACTS

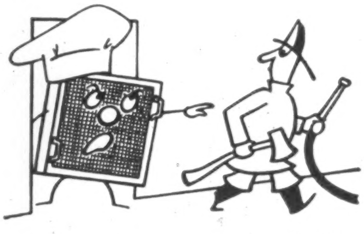
BY O. SOGLOW



HOW'S YOUR MILEAGE? Because you need so much air to live, you have to figure in terms of gallons you need to travel a mile, instead of miles per gallon. Walk briskly and you can breathe as much as 365 gallons of air . . . run and you can use up as much as 600 gallons . . . every mile. So it's important that the air you breathe is clean . . . a job well done with Air-Maze filters.



BAD AIR GETS FRESH START! Air-Maze air filters keep damaging dust and grit out of hotels, office buildings, stores—wherever clean air is required. Available in a large variety of types and sizes including unit panels, rotating curtains and self-washing electrostatic precipitators.



KEEPS FIREMEN OUT OF KITCHENS! Air-Maze Greastop filters snatch dirt and grease droplets out of the air, help to prevent fire hazards in commercial kitchen exhaust ducts. It's one of hundreds of filter types designed by Air-Maze—*the filter engineers.*

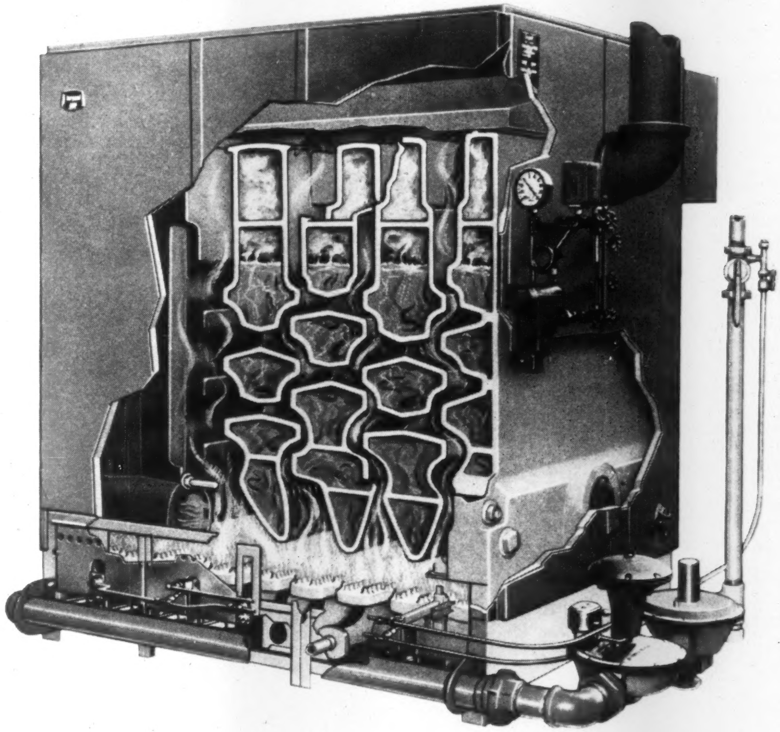
FOR AIR CONDITIONING AND VENTILATING EQUIPMENT, ENGINES, COMPRESSORS *or any device using air or liquids*—there is an Air-Maze filter engineered to solve each filtering problem. For new all-line catalog, write Air-Maze Corporation, Dept. D-2, Cleveland 28, O.

AIR-MAZE

The Filter Engineers

AIR FILTERS • SPARK ARRESTERS • LIQUID FILTERS
SILENCERS • OIL SEPARATORS • GREASE FILTERS

Finest in the nation for church, school, industrial or commercial installation!



Bryant Model 630 Boiler

EASIEST TO SELL! The 630 is the owner's assurance of more economical operation, longer life, less servicing, maximum comfort.

EASIEST TO INSTALL! Installing Bryant means more money in your pocket—because you save on time, labor, and materials.

PROBLEMS? Trained experts at the factory and field levels are available to assist you with installation or application problems.

RUSHED FOR TIME? Bryant offers you IMMEDIATE DELIVERY.

AND REMEMBER—Bryant is rated FIRST by leading utilities, architects, and engineers everywhere.

In addition to the 630, the Bryant 26, 225, and 446 models round out the most complete line of gas fired boilers in the industry.

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50 YEARS OF ENGINEERING SKILL, RESEARCH AND DEVELOPMENT ARE PACKED INTO THE 630

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NEW

line of power roof exhausters by one of the most trusted names in air-moving . . .

M-PEL-AIR

by BROOKSIDE

LOW SILHOUETTE

Beautiful *low* design complements long, low architectural lines.

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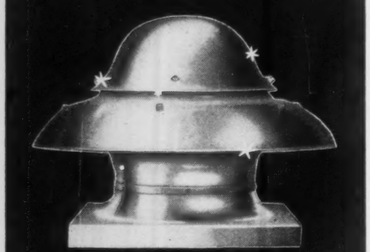
Rugged, precision assembly withstands constant, most abusive operation.

WHISPER QUIET

Backward inclined wheels will not overload and are perfectly balanced (statically *and* dynamically).



for Bulletin, write to

BROOKSIDE CORPORATION

McCordsville, Indiana

RECENT TRADE LITERATURE

Continued

illustrated, specific applications for each discussed. *Barber-Colman Co., Temperature Controls, Dept. HPAC, 1400 Rock St., Rockford, Ill.*

▶ *TEST EQUIPMENT*—Bulletin No. 2058, 6 pages, contains listings of test equipment for servicing air conditioning, heating equipment. Includes information on new testers including "Model 387" millivoltmeter for testing safety thermocouples on gas fired equipment. *Simpson Electric Co., Dept. HPAC, 5200 W. Kinzie St., Chicago 44.*

▶ *THREAD SEIZURE CAUSES*—New engineering data bulletin highlights mechanical, chemical causes of thread seizures as encountered in metal and oil refineries, chemical plants, power and steam generating stations. Offers technical data, recommendations. *Surveys, Inc., Dept. HPAC, 302 S. Olden Ave., Trenton N.J.*

▶ *TITANIUM PIPE, TUBING*—Technical data folder TDC-185 discusses seamless titanium metal pipe and tubing for use in severe corrosive environments. Presents size range, tolerances. Describes mechanical, physical, working properties. *Tubular Products Div., Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▶ *V-DRIVES*—Information on fhp to 10 hp v-drives, drive parts, accessories contained in new 46 page catalog, form F-10. Literature presents descriptions, size data on line of bushed type and fixed bore type cast iron and pressed steel v-pulleys, v-belts, refrigeration fans and fan pulleys, v-drive accessories. *Maurey Mfg. Corp., Dept. HPAC, 2915 S. Wabash Ave., Chicago 16.*

▶ *VIBRATION CONTROL*—*Vibration Control Specifications for Air Conditioning Equipment* is title of 4 page reprint, bulletin F2C. Covers

"In this Union there is strength"

. . . it's CAPITOL 300# forged steel UNION!

Continual testing and inspection assure water-tight seat, close tolerance and accurate threads.

- Brass or integral steel seat
- Sizes 1" through 2" ALL forged steel
- Smaller sizes machined from solid bar
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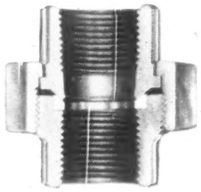
- Meets all Federal Specifications



the U.L. label guarantees quality

the packaging assures profits!

Available from stock in sizes ½" through 2", 300# steam or 2000# cold water, oil or gas, non-shock.

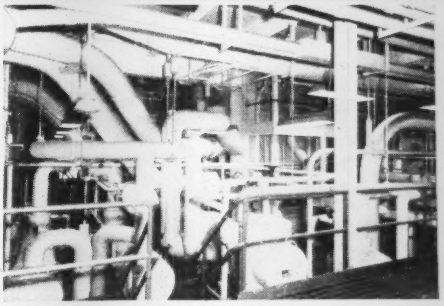
Order all your fittings from

CAP CAPITOL MFG. & SUPPLY CO.

COLUMBUS, OHIO

COUPLINGS — NIPPLES — UNIONS — BUSHINGS — PLUGS — REDUCERS — CAPS—CAPADAPTERS—WELL SUPPLIES

BLAW-KNOX has what it takes—to provide these products and services



Heater piping system in this modern generating station is typical of many high temperature, high pressure systems prefabricated and erected by Blaw-Knox. Experienced piping engineers, modern shop facilities and a new Blaw-Knox digital computer method for fast, accurate calculation of piping stresses are available to you. Let us know your requirements and we'll provide the service you need. For more information, write for Bulletin No. 2443—"Piping for Industry."

Out of every 100 firms who lose their records in a fire, 43 never reopen for business. Be safe. Let a Blaw-Knox fire-protection engineer study your needs—and explain how you can pay for the system on our lease or deferred payment plan. To get more information send for Bulletin No. 2426—"Fire Can Destroy Your Business."

Blaw-Knox trapeze functional spring hanger installed in first large atomic generating station. Vital power piping system for the atomic generating unit in the Duquesne Light Company's Shippingport Station is supported by Blaw-Knox custom-engineered hangers.

Blaw-Knox makes a complete line of standard and custom-engineered pipe hangers, supports, and vibration eliminators. Each is a complete packaged unit, designed for a specific purpose and constructed to comply with the "code for pressure piping." Available in types and sizes to meet varying conditions, ready to install.

Blaw-Knox engineers, who have solved many difficult hanger and piping vibration problems, are always available to both design and make recommendations for your hanger requirements. For further information, write for Catalog No. 54.

BLAW-KNOX

BLAW-KNOX COMPANY

Power Piping and Sprinkler Division
829 Beaver Avenue • Pittsburgh 33, Pennsylvania

Complete facilities for prefabrication and erection of piping systems for all pressures and temperatures
...complete line of standard and custom-engineered pipe hangers, supports and vibration eliminators
...complete line of automatic sprinkler systems for standard and special hazards

GACO
THE MARK OF CORROSION PROTECTION

Men
who know
specify
GACO

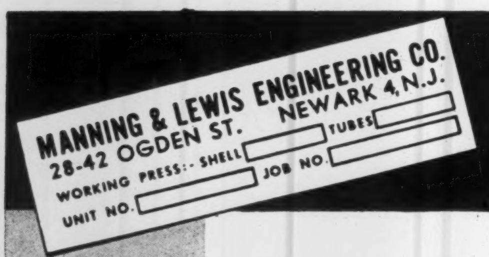
to stop corrosion in
cooling tower drip pans

You don't have to be a hot engineer to know that cooling tower drip pans corrode rapidly. That's why men who know—the supervising engineer of the great new Socony Mobil Building in New York, for instance—specified GACO to avoid pan replacement every few years.

Here's how to stop corrosion in drip pans: Apply GACO N-200 liquid neoprene lining—a tough, flexible coating that adheres strongly to metal . . . will not crack or chip . . . and is virtually unaffected by salt spray, sunlight, or corrosive atmospheres. For piping and structural steel use GACO N-700 liquid neoprene maintenance coatings.

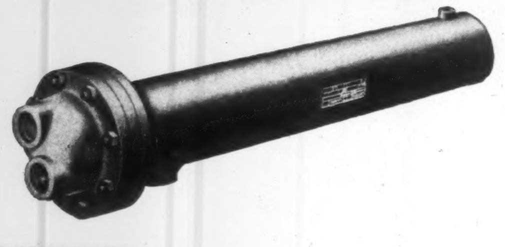
GACO coatings are performance-proven on cooling tower installations in The Socony Mobil Building, Radio City, and Ohrbach's in New York—to mention just a few. *Write for complete information*

PIONEER LEADER IN PROTECTIVE COATINGS
GATES ENGINEERING COMPANY • WILMINGTON 99, DELAWARE



MANNING & LEWIS ENGINEERING CO.
28-42 OGDEN ST. NEWARK 4, N.J.
WORKING PRESS:- SHELL ☐ TUBES ☐
UNIT NO. ☐ JOB NO. ☐

FUEL OIL
HEATERS
WATER HEATERS
and COOLERS



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Heat Exchangers
Condensate Coolers
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Tankless Water Heaters
Instantaneous Water Heaters

PRESCRIBED . . .
WHERE DEPENDABILITY IS A MUST ! !

When the Alexian Brothers Hospital in Elizabeth, N. J. developed a fuel oil preheating problem, Manning and Lewis were consulted as specialists in this field. The illustrated unit was designed and fabricated to meet all necessary requirements. For years it has delivered, and continues to deliver the type of perfect service demanded of heating systems in modern hospitals — efficient, economical and completely dependable.

Manning & Lewis Engineering Company
DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT
28-42 OGDEN STREET NEWARK 4, NEW JERSEY
M.L

RECENT TRADE LITERATURE

Continued

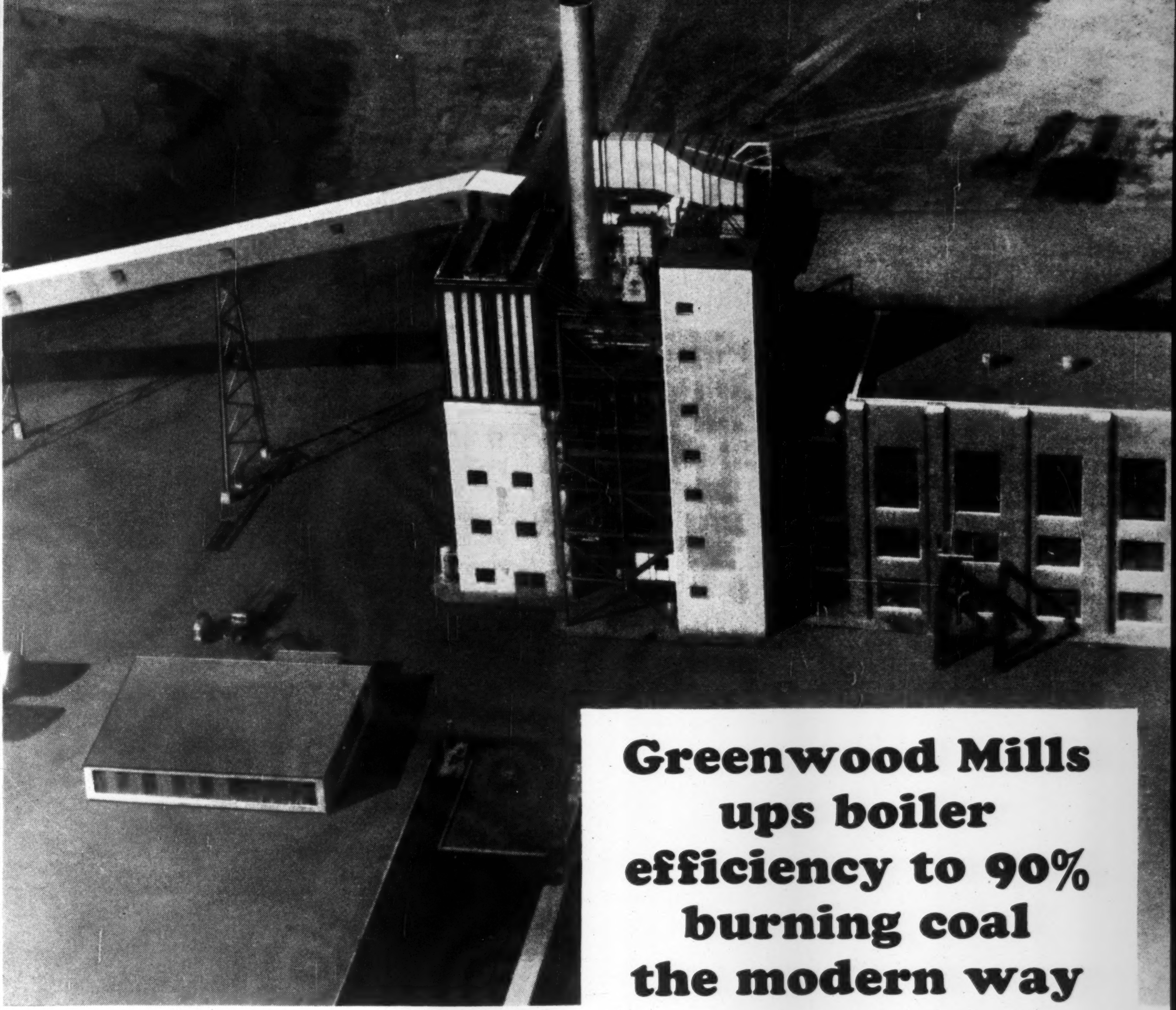
factors in selecting isolation medium, isolation media, installation. Includes tables of specifications, typical specification paragraphs. *Korfund Co., Inc., Dept. HPAC, 48-15 32nd Pl., Long Island City 1, N.Y.*

▶ *WATER CONDITIONERS*—Revised 4 page bulletin describes theory behind method of preventing, eliminating hard water scale and corrosion which involves passing water through magnetic field created by alnico magnets. Information covers application of water conditioners to boilers, steam generators, air conditioning systems. Includes specifications, engineering data, prices. *Packard Water Conditioner Div., Inc., Dept. HPAC, 2220 W. Beaver St., Jacksonville, Fla.*

▶ *WATER CONDITIONING*—Four page reprint contains readers' comments to earlier reprint of article, *The "New" Water Conditioning Gadgets—Do They Work? E. W. Smith Chemical Co., Dept. HPAC, 15020 E. Proctor Ave., La Puente, Calif.*

▶ *WATER TREATMENT*—*Selecting Water-Treating Processes for Medium-Pressure Boilers* is title of 8 page reprint No. 111. Paper was presented at ASME meeting, December 1956. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny Ave., Philadelphia 32.*

▶ *WELDING*—Two new wall charts, designed for technical schools and plant training programs in practical aspects of torch and arc welding, available from company. Torch applications chart (TIS 2690) explains meaning of low temperature welding, examines good and bad of common joint design. Metallic arc applications chart (TIS 2689) explains benefits of low heat input. *Eutectic Welding Alloys Corp., Dept. HPAC, 40-40 172nd St., Flushing 58, N.Y.*



Greenwood Mills ups boiler efficiency to 90% burning coal the modern way

Consult an engineering firm

Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities—or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

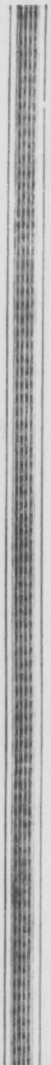
In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

When its original power plant could not keep up with growing steam demand, Greenwood Mills, Greenwood, S. C., studied the problem and decided to replace the old facilities.

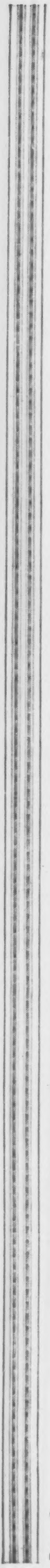
Greenwood's engineering and construction departments, working with Consulting Engineer Frank Hill of Greenville, designed and built a completely modern power plant. It features a pressurized 300,000 lb./hr. boiler equipped with two cyclone furnaces burning ¼" x 0" coal. Automatic throughout—from coal conveyors to pneumatic combustion control to hydraulic ash handling—the system is manned by a minimum of operators. Burning coal the modern way has resulted in a trouble-free boiler plant operating at a combustion efficiency of 90% or better.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

BITUMINOUS COAL INSTITUTE
Southern Building • Washington 5, D. C.



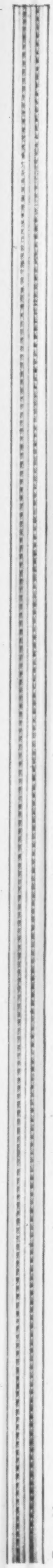
Slot STRIPLINE DIFFUSERS by AGITAIR® Slot



STRIPLINE combines the best features of both slots and efficient air diffusers to provide equalized air flow throughout its entire length.

STRIPLINE slot diffusers are slenderly designed, inconspicuous, practical and versatile.

These slot diffusers can be located in walls, ceilings, coves, mouldings, window reveals and stools or almost anywhere to suit interior design.



Write for complete Stripline Catalog.

AIR DEVICES INC. • 185 MADISON AVENUE • NEW YORK 16, N. Y. • AIR DIFFUSERS • FILTERS • EXHAUSTERS

WHO'S WHAT . . .

(New personnel, promotions)

▶ *NATIONAL BUREAU OF STANDARDS*—Paul R. Achenbach, head of newly reorganized air conditioning, heating and refrigeration section of building technology division.

▶ *WORTHINGTON CORP.*—Walther H. Feldmann, president; Edwin J. Schwanhausser, vice chairman of the board.

▶ *AMERICAN WELDING SOCIETY*—New officers for 1957-58 fiscal year include: Clarence P. Sander (general superintendent, Vernon plant, Consolidated Western Steel Div., United States Steel Corp.), president; Gustav O. Hoglund (head, welding section, Alcoa process development laboratory), first vice president; Charles I. Mac Guffie (manager of marketing, welding department, General Electric Co.), second vice president; Harry E. Rockefeller (manager, electric welding, Linde Co.), treasurer.

▶ *CRANE CO.*—Neele E. Stearns, a director. Mr. Stearns was named president of the company the first of the year.

▶ *DUNHAM-BUSH, INC.*—Alan S. Decker and Frank T. Carney, vice presidents of engineering and purchasing, respectively.

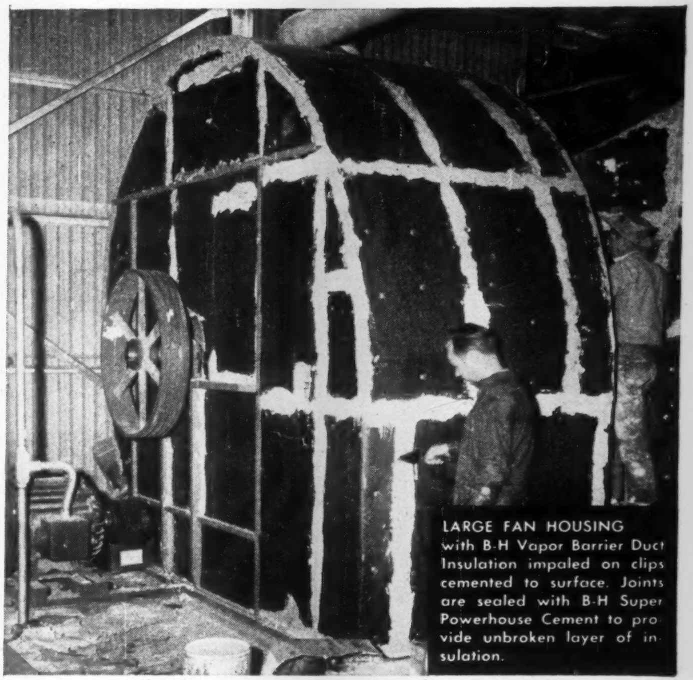
▶ *IRON FIREMAN MFG. CO.*—Lewis J. Cox, first vice president and chief executive officer; Orval D. Berry, vice president.

▶ *TRANE CO.*—John Kennedy, manager of industrial engineering department.

▶ *LIMA REGISTER CO.*—Norman F. Jones, general manager; C.B.Armour, sales manager.

▶ *CARRIER CORP.*—Fred F. Hoyt, vice president in charge of long range economic planning; Melvin C. Holm, chief financial officer and treasurer, succeeding Mr. Hoyt; Leon C. Hutton, executive assistant to Mr. Holm and comptroller; William Alvord, manager of Unitary Equipment Div.'s business consulting department, replacing Mr. Hutton; Thomas P. Rhoades, assistant to the chairman of the board; George Lilygren, in charge of newly formed Corporate Development Div.; Charles V. Fenn, general manager of Machinery and Systems Div., succeeding Mr. Lilygren; George T. Long, director of marketing, Unitary Equipment Div.;

for THERMAL *and* ACOUSTICAL EFFICIENCY *put the job up to*

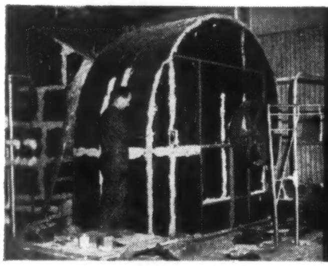


LARGE FAN HOUSING with B-H Vapor Barrier Duct Insulation impaled on clips cemented to surface. Joints are sealed with B-H Super Powerhouse Cement to provide unbroken layer of insulation.

Insulation Contractor:
The Aber Co., Athens, Texas

BALDWIN-HILL *Spun Mineral Wool*

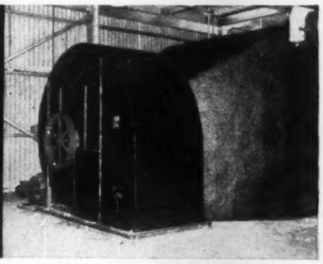
DUCT INSULATION

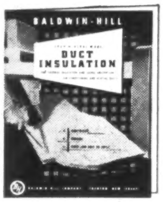


1" wire mesh attached over B-H Duct Insulation preparatory to . . .

Engineering objectives in building this fan housing called for insulation to maintain temperatures of 80° to 90° F. . . . deaden noise . . . and dampen vibration. B-H DUCT INSULATION was selected for its high thermal efficiency, sound and vibration absorption qualities. Also contributing largely to its choice is the ease and low cost of installation. Lightweight, semi-rigid, resilient sheets are easily cut to irregular shapes; bend readily around large radii without breaking and necessity of scoring; are non-irritating to handle; and are moisture and corrosion resistant.

. . . trowelling on ¼" coat of asphalt emulsion for a final protective coating.





BALDWIN-HILL
DUCT INSULATION

Send for literature describing B-H DUCT INSULATION and giving suggested methods of application. For other B-H insulating products, see Sweet's Engineering File.

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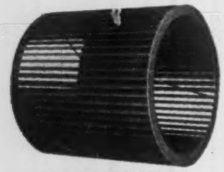
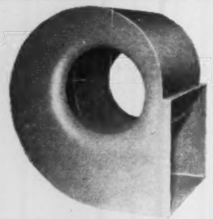
We offer users of power fan equipment a full line of blowers, multiple blower assemblies, direct and belt driven ventilating sets, cast iron blowers and various types of centrifugal blower wheels and housings. All sizes from 6" to 73".

ALL BARRY blower wheels and housings are precision made from steel, aluminum, brass, copper or stainless, and are expertly balanced and trued before shipment.

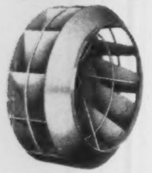
We make power fan equipment *exclusively,* and do not compete with our own customers . . . . . and, we have a high reputation for dependable quality and remarkably fast deliveries. Let us quote on our standard equipment, or upon your special sizes and specifications. Write us today.



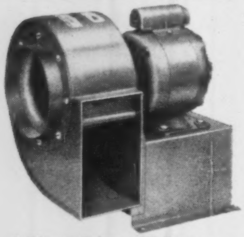
BFC, DI-DW Wheel



BFC, DI-DW Housing



BBI Blower Wheel SI-SW. Class 2.



Direct Drive, All-Purpose Utility Blower

BBI Blower, SI-SW Arrangement No. 3, class 4

REPRESENTATIVES

A few territories available for sales representatives

BARRY BLOWER COMPANY

3100 California Street N.E. • Minneapolis 18, Minnesota

William A. Lake, sales manager, Unitary Equipment Div. John M. Bickel, recently retired as vice president of Carrier and general sales manager of its Unitary Equipment Div., will be retained as a consultant.

▶ *NATIONAL-U.S. RADIATOR CORP.*—William G. Smith, service manager for air conditioning division.

▶ *COPELAND REFRIGERATION CORP.*—Guy S. Peppiatt, a director.

▶ *SERVEL, INC.*—John H. Wall, a director; William W. Wallace, a vice president.

▶ *TORRINGTON MFG. CO.*—R. O. Kennedy, Jr., sales manager of air impeller division.

▶ *SUN-RAY BURNER MFG. CO.*—G. M. Marin, chairman of the 22nd National Oil Heat and Air Conditioning Exposition of Oil-Heat Institute of America, Inc. Mr. Marin is president of Sun-Ray.

▶ *CANTON STOKER CORP.*—J. C. Fosselman, sales manager of stoker division; G. E. Romary, sales manager of Wagener Pump Div.

▶ *WHITE-RODGERS CO.*—Gerry Powell, assistant sales manager.

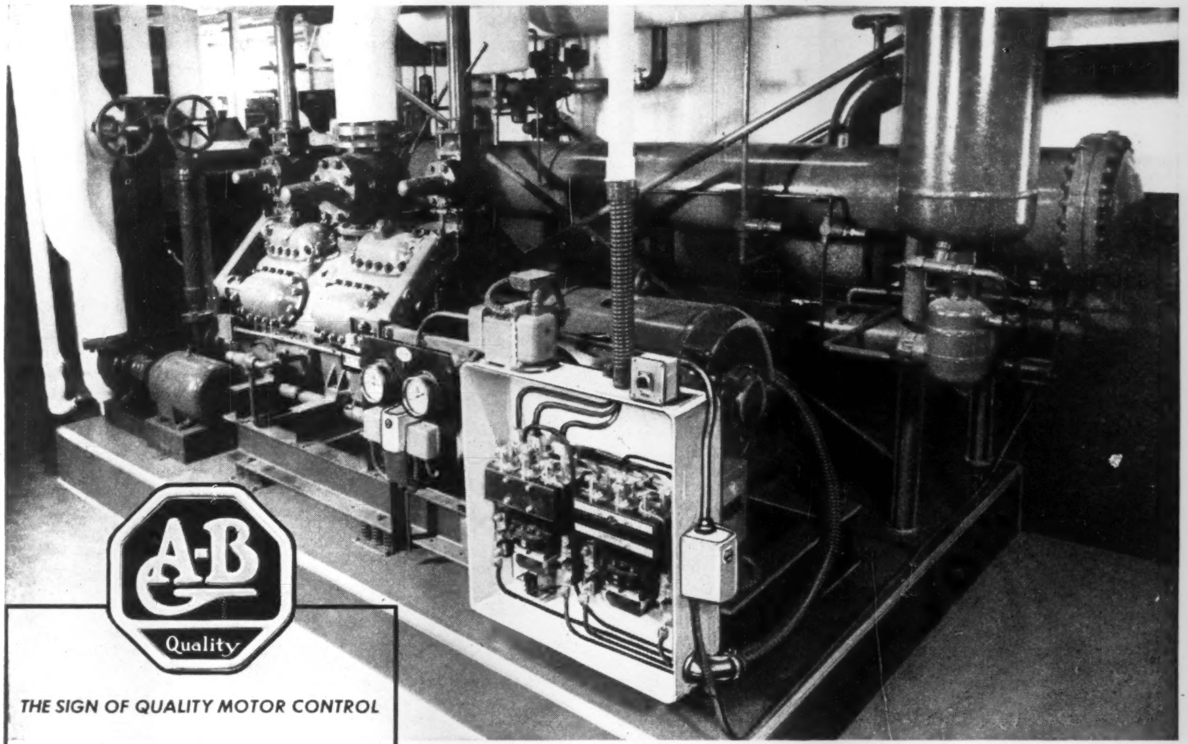
▶ *IRON FIREMAN MFG. CO.*—R. K. Handley, a vice president; Ralph W. Freeman, manager for company's plants 1 and 2 in Cleveland.

▶ *OLIN MATHIESON CHEMICAL CORP.*—E. W. Ruhe, "Roll-Bond" manager of company's Western Brass Mills Div.

▶ *JOHNS-MANVILLE CORP.*—Jack E. Hesse, manager of new asbestos-cement pipe plant under construction at Denison, Tex.

▶ *RELIANCE ELECTRIC & ENGINEERING CO.*—Richard A. Geuder, general manager, marketing; Carl V. Gregory, sales manager.

▶ *BABCOCK & WILCOX CO.*—Marcel A. Cordovi, recipient of the second annual industrial achievement award of the New York chapter of the American Society of Metals. Mr. Cordovi is head of the materials



Bulletin 736 part-winding starter on large York compressor

GRIPES about lamp flicker cured
with these A-B reduced voltage starters

High starting current inrush—the cause of "lamp flicker"—can be brought down to the power company's limitations with one of the Allen-Bradley starters shown on this page.

Bulletin 640 manual velvet smooth compression resistance starters provide stepless acceleration of the motor from standstill to full speed without lamp flicker.

Bulletin 740 automatic 2-step compression resistance starter . . . the automatic equivalent of Bulletin 640 manual starter.

Bulletin 742, the ideal automatic starter for increasing starting current steplessly, thus eliminating "lamp flicker" on network systems.

Bulletin 646 is a manually operated autotransformer type starter with either 2 or 3 reduced voltage taps.

Bulletin 746 automatic equivalent of Bulletin 646 manual starter. Rated up to 300 hp, 220 v; 600 hp, 440-550 v.

Bulletin 736 part-winding starter, shown above, can be used with squirrel cage motors having two separate parallel stator windings. Where starting current comes within power company's limitation, the result is a satisfactory, low cost installation.

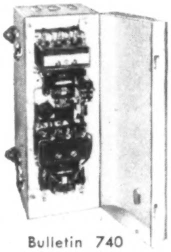
When you have difficulty in deciding which starter to use, an Allen-Bradley sales engineer will gladly help you with your problem. Please call our nearest office.

Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

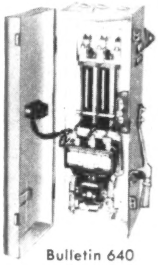
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

A-B
Quality

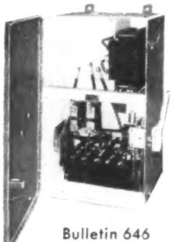
THE SIGN OF QUALITY MOTOR CONTROL



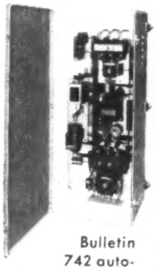
Bulletin 740 automatic resistance starter.



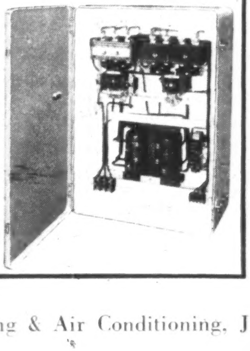
Bulletin 640 manual resistance starter.



Bulletin 646 manual autotransformer starter.



Bulletin 742 automatic resistance starter.



Bulletin 746 automatic autotransformer starter in general purpose enclosure.

and testing department of B&W's atomic energy division.

▶ *BIRD-ARCHER CO.*—Charles W. Bird, Jr., president.

▶ *JOHN WOOD CO.*—Patrick N. Morgan, assistant to vice president and general sales manager of heater and tank division.

▶ *POWDER ACTUATED TOOL MANUFACTURERS' INSTITUTE*—A. G. Lane, director of training and safety.

▶ *HUPP CORP.*—Willard A. Giddens and James F. Rowe, vice presidents.

▶ *RADIANT HEAT & COOLING CORP.*—Erwin H. Klaus, vice president in charge of marketing.

▶ *NORTH AMERICAN MFG. CO.*—Clark E. Hague, director of engineering of recently formed hydraulic controls division.

▶ *COMBUSTION ENGINEERING, INC.*—Arthur J. Santry, Jr., a vice president and a director.

▶ *METALS & CONTROLS CORP.*—John F. Wilson, general manager of marketing.

▶ *THOR POWER TOOL CO.*—William J. Laughlin, industrial division manager.

▶ *SCAIFE CO.*—Walter D. Wood, vice president, sales.

▶ *FULTON SYLPHON DIV., ROBERTSHAW-FULTON CONTROLS CO.*—A. W. Roat, applications engineer, controls sales section.

▶ *COLEMAN-GOOD, INC.*—John R. McClain, superintendent of heating construction for the Pittsburgh mechanical contracting firm.

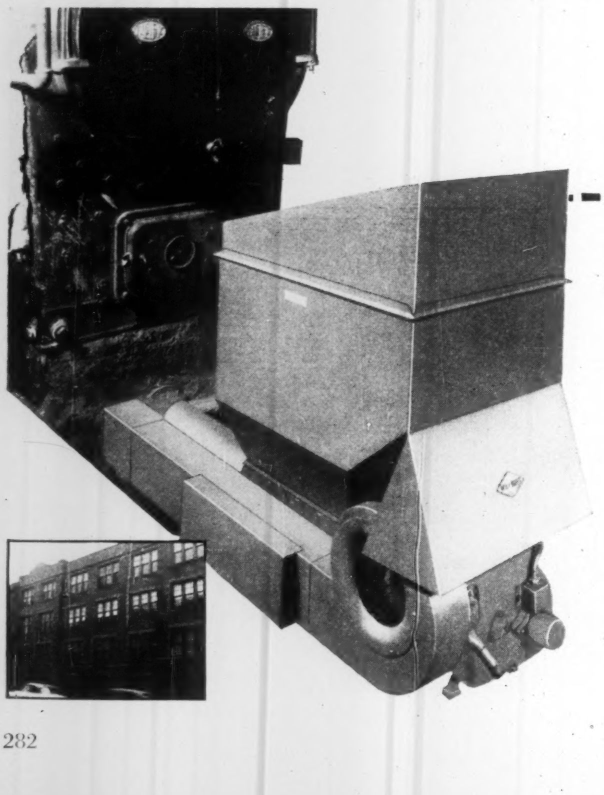
▶ *DELAVAN MFG. CO.*—Jack D. Brown, sales engineer in agricultural and industrial division.

▶ *TEXAS VITRIFIED PIPE CO.*—O. B. Lance, director of advertising and public relations.

Performance Proves it...

the modern method to more heat per fuel dollar . . .

....fuel saving 25%!



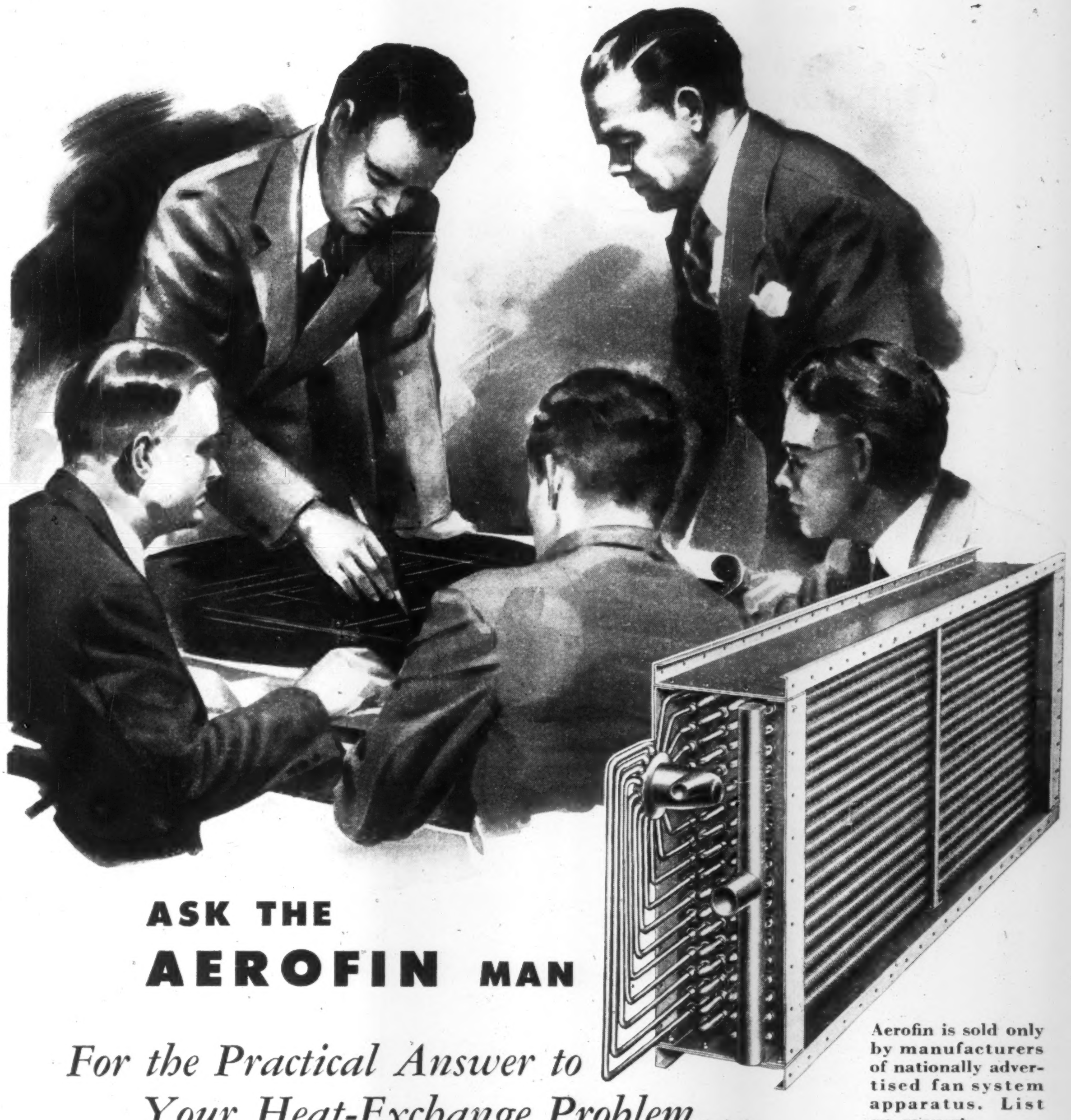
WILL-BURT
STOKERS
ORRVILLE, OHIO

This Will-Burt Hopper Stoker Model is used in a large apartment in Chicago. Installed approximately one year ago it has already produced fuel savings of 25%!

Added benefits . . more uniform temperature control, less custodian supervision.

Air Controlled WILL-BURT STOKER

Write for literature. Engineering and advisory services available.



ASK THE AEROFIN MAN

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

For the Practical Answer to Your Heat-Exchange Problem . . .

There is a competent Aerofin heat-transfer engineer near you, qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem.

This specialized knowledge is there, ready for you to use to your greatest advantage. Ask the Aerofin man — and be right.

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

WHO'S WHAT

Continued

▶ *ALUMINUM CO. OF AMERICA*—John B. West, a director of National Association of Corrosion Engineers. Mr. West is a development engineer in Alcoa's Atlanta district sales office.

▶ *WATER SERVICE LABORATORIES, INC.*—John J. Constantino, assigned to chemical department.

▶ *OLIN REVERE METALS CORP.*—John J. Miller, general manager of alumina division.

▶ *TYPHOON AIR CONDITIONING CO.*—William E. Vandiveer, publicity editor.

▶ *RODNEY METALS, INC.*—Herbert G. Milner, special sales representative.

▶ *ROBINSON CLAY PRODUCT CO.*—Clark Sutherland, first vice president; J. J. Starr, second vice president; P. V. Robinson, secretary-treasurer; S. L. Robinson, assistant secretary; Powers McLean, clerk. Named to board of directors are: R. A. Ferreira, W. A. Humphreys, Jr., Henry Robinson, P. V. Robinson, P. V. Robinson, Jr., S. L. Robinson, W. E. Robinson, A. G. Saalfield, J. P. Seiberling, Clark Sutherland. Members of the executive committee are Messrs. Ferreira and Sutherland and P. V. and W. E. Robinson.

IN THE TERRITORIES . . .

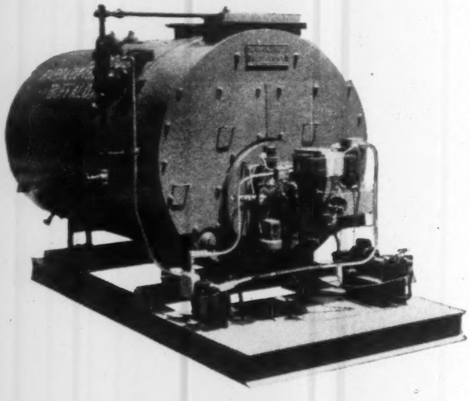
(Recent sales appointments)

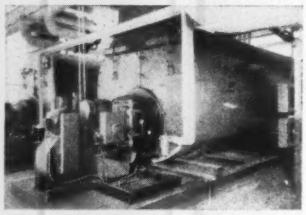
▶ *ELLIOTT CO.*—Charles L. Hoebel, district manager of New York office.

▶ *TRANE CO.*—John P. Rodgers, manager of new sales office in Akron; Fred Manget, Jr., manager of New Orleans office, succeeding William D. Graham, Sr., retired.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—Del E. Wessels, technical sales representative in Oklahoma, north Texas areas.

▶ *AIRTHERM MFG. CO.*—Recently named representatives are: Landes, Zachary & Peterson, Denver; R. C. Schneider Co., Wauwatosa, Wis.; Tri-State Equipment Co., Preakness, N.J.; Stellingworth & Feely, Grand Rapids, Mich.





Two BISON Super Scot Low-Pressure Boilers at Sylvania Electric Products, Inc., Batavia, N. Y. Engineers and General Contractors, Siegfried Construction Co., Inc., Buffalo, N. Y.; Heating Contractors, Joseph Davis, Inc., Buffalo, N. Y.

BISON

SUPER SCOT BOILERS

for packaged heating units

To the best in the century-old Scotch Boiler with its tried-and-true two-pass design, BISON Super Scot Low-Pressure Boilers offer a number of advantages made possible by their exclusive features.

Per unit of heating surface, Super Scot Boilers are bigger. They have a larger furnace, more steam space and water content. The area directly exposed to the radiant heat of combustion is a greater percentage of the total heating surface. Certified ratings are moderate but extra loads can be handled with larger burners.

Results—smokeless combustion, extra capacity for peak loads, lower maintenance, longer life and less cost of steam generated.

Consult F & T also for high-pressure boilers.

ADSCO DIVISION
YUBA INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

▶ *CARRIER CORP.* Named unit heater distributors are: Norman S. Wright and Co., Arizona; McMillan Equipment Co., Houston.

▶ *WALWORTH CO.* William M. Combs, vice president of Gulf Div.

▶ *FAIRBANKS CO.* Leland L. Bogle, representative for Tennessee, Alabama, northern Mississippi; William J. Kaiser, Jr., to cover western New York sales territory.

▶ *MARSH HEATING EQUIPMENT CO.*—R. B. Sweet and Assoc., representative for Philadelphia territory; J. N. Doyle Co., to cover Colorado.

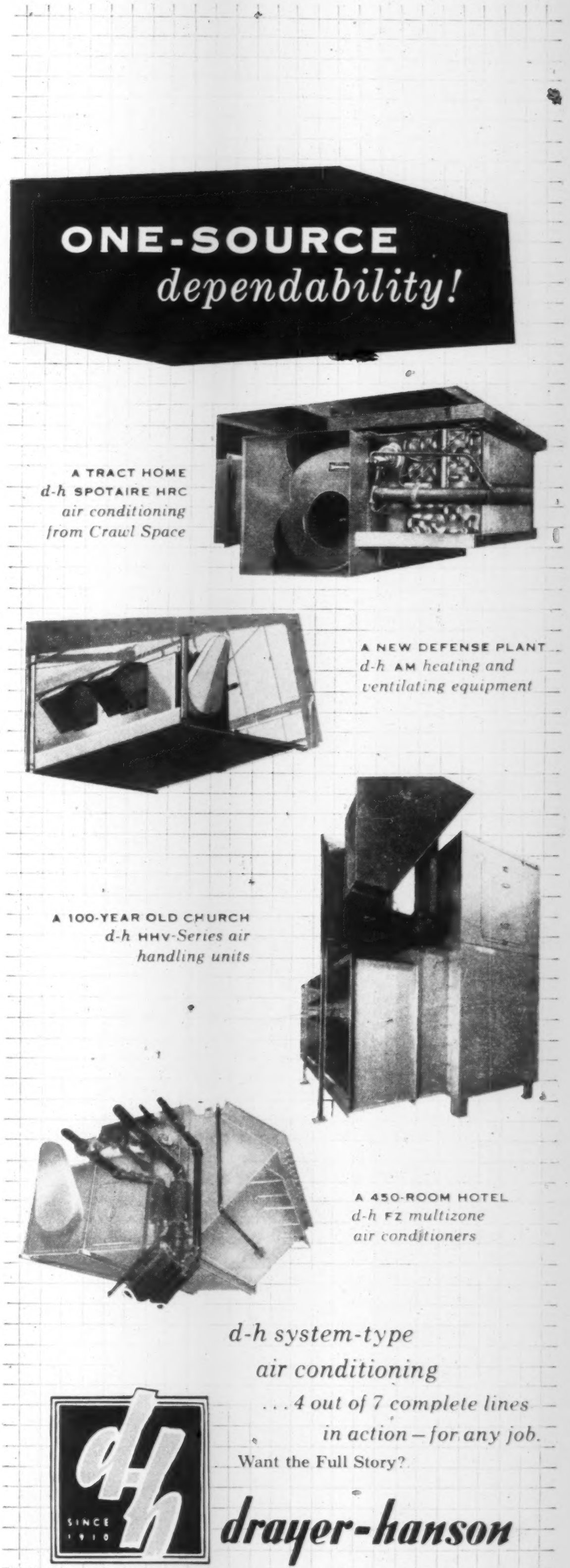
▶ *WHEELCO INSTRUMENTS DIV., BARBER-COLMAN CO.*—H. J. Hoffman, manager of new Columbus, Ohio, sub-branch office. The division's Cincinnati and Houston branch offices have been moved to 8016 Plainfield Rd., Cincinnati 36, and 2712 Danville, Houston 6, respectively. Sales and service appointments include: Beryl Martin Johnson, service staff, Columbus; J. Richard Manier, sales engineering staff, Cleveland; Clemens Matula, sales engineering, Chicago; Otto Schemmel, service engineering, Chicago; Marion L. Jones, service engineering, Grand Rapids; Lloyd J. Austin, service engineering, Los Angeles; George F. Draper, service engineering, Barber-Colman, Ltd., Toronto; James P. Whitehead, branch sales manager, Barber-Colman, Ltd., Montreal.

▶ *ROBERTSHAW-FULTON CONTROLS CO.*—Ralph J. Davidson, representative for Pacific Southwest area for company's heating controls division.

▶ *JOSEPH T. RYERSON & SON, INC.*—Robert H. Wasz, general manager of San Francisco steel service plant; Hardie W. Beck, sales manager for Pittsburgh plant; Milton C. Fidgeon, assistant sales manager of New York area plant.

▶ *HAMMOND BRASS WORKS*—Herman Hogrefe, Inc., northern California sales representative; William D. Burk, representative for Alaska.

▶ *DEMING CO.*—Robert Kaltenbach, factory sales representative in eastern Wisconsin, northern Illinois; William T. Gibson, to cover western Wisconsin, Minnesota, the Dakotas, Montana.



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dependability!

A TRACT HOME
d-h SPOTAIRE HRC
air conditioning
from Crawl Space

A NEW DEFENSE PLANT
d-h AM *heating and*
ventilating equipment

A 100-YEAR OLD CHURCH
d-h HHV-*Series air*
handling units

A 450-ROOM HOTEL
d-h FZ *multizone*
air conditioners

d-h system-type
air conditioning
. . . 4 out of 7 complete lines
in action—for any job.

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DIVISION OF NATIONAL-U.S. RADIATOR CORP.

PROPELLAIR®

it moves the air...

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"QUIETLY"
NEW

...whisper-quiet performance

Where noise adds to costly confusion you are wise to install whisper-quiet Propellair Type "QD" fans. The efficient air foil design of the rigid, precision balanced, cast aluminum propeller eliminates vibration noise and the sounding board effect of ordinary thin sheet metal blades. The special blade pitch delivers high volumes of air at quieter, lower speeds. Noise is further reduced by Propellair's steel venturi entrance ring. Powered by dependable, totally-enclosed Robbins & Myers motors, they are available in sizes from 12" to 36". Air delivery capacities from 1235 to 12000 CFM.

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DIV. OF ROBBINS AND MYERS, INC.
SPRINGFIELD, OHIO

Certified Ratings PFMA

MAN COOLER
SKY-BLAST
VANEAXIAL
TUBEAXIAL
EXTENDED SHAFT

MOVING AIR IS OUR BUSINESS

WHO'S WHAT

Continued

▶ *MUELLER BRASS CO.*—New sales representatives and offices to which they are assigned are: John R. Montrose, San Francisco; John M. Powell, Cincinnati; John A. Berka, Newark.

▶ *ROCKWELL MFG. CO.*—Herbert Parker, Atlanta district manager for company's meter and valve division.

▶ *INLAND STEEL PRODUCTS CO.*—Robert E. Brown, representative in New Orleans district.

▶ *REFRIGERATION APPLIANCES, INC.*—Hubert R. Hunt of Tri-Cities Engineering Co., representative for Virginia, West Virginia, the Carolinas.

▶ *AIR REDUCTION SALES CO.*—H. C. Wallace, assistant regional sales manager of company's southern region; A. C. Pease, district manager of Louisville sales office, succeeding Mr. Wallace.

▶ *BARNES MFG. CO.*—James E. Crum, central district sales supervisor. His territory includes Ohio, lower Michigan, western Pennsylvania, northern Kentucky.

▶ *TYPHOON AIR CONDITIONING CO.*—Lawrence A. Phipps, Texas district manager.

▶ *THOR POWER TOOL CO.*—Recently appointed branch managers are: Clarence H. Gabriel, Los Angeles; Mark A. Sorenson, Denver; John L. MacDonald, Philadelphia; Albert C. Cheswick, Newark.

▶ *AMANA REFRIGERATION, INC.*—J. David Cathcart, regional sales manager of new Philadelphia territory. New distributors are: Modern Distributing Co., Cincinnati area; Intrasouth Distributing Div. of Interstate Electric Co., Shreveport area; Washington Wholesalers, Inc., District of Columbia and surrounding counties.

▶ *FLORI PIPE CO.*—William E. Keim, New York district sales manager; Paul D. Broussard, sales manager for Houston area; Herman C. Heink, midwest district sales representative.

▶ *MARCO INDUSTRIES, INC.*—Roland S. Boreham Co., representative for southern California, southern Nevada, Arizona.

WHO'S WHAT

Continued

▶ *CONOFLOW CORP.*—Brown & Morrison, sales agent for the Carolinas. J. R. Simpson & Co., Conoflow's northern Illinois-northwestern Indiana representative, has added George H. Freundlich and Richard G. Klitchman to its staff as sales engineers.

▶ *MITCHELL MFG. CO.*—Jos. M. Zamoiski Co., distributor in Washington, D.C., trading area.

▶ *RUBEROID CO.*—Edward R. Gardner, assistant sales manager of Erie, Pa., district.

▶ *O. A. SUTTON CORP., INC.*—Sylvania Sales Corp., distributor for room air conditioners, air circulators in eastern Massachusetts. Field engineers added to service department are: J. Shenos, Jr., Washington, D.C.; Jim Middleton, California; Claude Rhea, Memphis.

▶ *RESEARCH-COTTRELL, INC.*—Hugh D. O'Rourke, Chicago district sales manager. He succeeds R. W. McCandlish who has been transferred to Bound Brook, N.J., as special assistant to vice president in charge of sales.

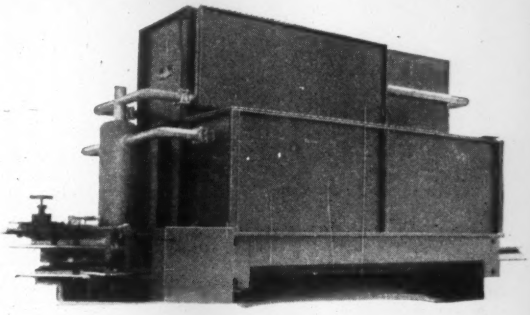
▶ *ELECTRIC FURNACE-MAN, INC.*—Recently appointed district managers are: Harrison G. Stortz, western New York State, parts of northern Pennsylvania; Arthur P. Ennis, western New England; Glenn A. Kepner, southern Pennsylvania, southern New Jersey, Maryland, Delaware.

▶ *AMERICAN STEEL BAND CO.*—G. K. Bradford and T. B. Evans, Pittsburgh and Cincinnati district managers, respectively; Jim Ammerman and Benton Williams, Pittsburgh sales representatives.

▶ *REEVES STEEL AND MFG. CO.*—Crawford-Mazer Co., representative for "TiteKote" continuous galvanized sheets in southern peninsula of Michigan.

▶ *DIEHL MFG. CO.*—Thomas R. Donnelly, sales agent for western Pennsylvania, Wheeling, W. Va.

▶ *AMERICAN POTASH & CHEMICAL CORP.*—Bob J. Johnson, representative for new Middle Atlantic territory for company's air conditioning and refrigeration department. The area includes Maryland, Delaware, Washington, D.C., parts of New Jersey and Pennsylvania. ‡



NIAGARA SECTIONAL
***Aeropass* CONDENSER**
gives you lower cost refrigeration,
*saves you **LABOR,** Power, Water*

- **Because Niagara "Duopass" pre-cooling removes super-heat and gas condenses at lower temperature.**
- **Because the system is automatically purged of oil.**
- **Because the new design improves the heat transfer to the out-door air by evaporation.**
- **Because these features keep the condenser working for long life with "new plant" efficiency... always full capacity.**
- **Because you save 95% of cooling water cost.**

You save labor in upkeep. With full access to all parts and interior piping you see everything in easy inspections. You head off dirt accumulation and corrosion. Casing panels are removable without moving the coils. The coils can be cleaned from both sides.

First cost is low; freight is low because of the lowest space/weight ratio; you save much labor in erection. Capacity range is 90 to 240 tons. No other condensing method gives you so much saving in money and trouble.

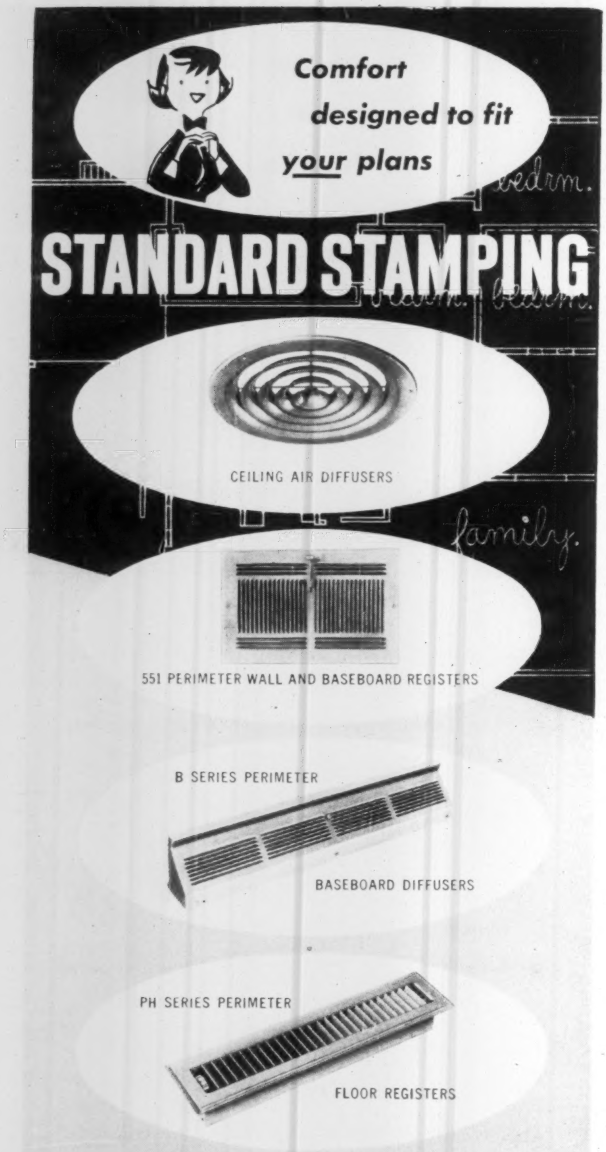
Write for Niagara Bulletin 131.

NIAGARA BLOWER COMPANY

Dept. HP-6, 405 Lexington Avenue
NEW YORK 17, N. Y.
District Engineers in Principal Cities

NIAGARA Aeropass
SECTIONAL CONDENSER

NIAGARA *Over 40 Years' Service in Industrial Air Engineering*



for two-way heating-air conditioning systems!

For every size and shape of conditioned space, there's a Standard Register engineered to turn warm or cool air into draft-free comfort, without blasts, hot spots, or cold corners.

Mail coupon now for new free catalog!

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STANDARD STAMPING & PERFORATING CO.
3125 W. 49th Place, Chicago 32, Ill.
Please send your new Registers & Grilles catalog.

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Firm______________________________
Address____________________________
City________________Zone_____State________

PUT A WARM AIR REGISTER UNDER EVERY WINDOW

WE HEAR THAT . . .

▶ What is said to be the world's largest installation of packaged heat pumps is in operation at the new plant of *AMERICAN COILS CO.* The 63,000 sq ft. single-story office and manufacturing building, located at Farmingdale, N.J., is equipped with 14 free standing heat pumps totalling 123 hp. According to *MICHAEL PARCARO*, American Coils president, the installation of water-to-air units supplied more than adequate heat during a recent cold snap even though it operated at only 60 percent of capacity.

▶ *W.M. STEINEN MFG. CO.* celebrated its 50th anniversary recently. The years have seen the company grow from a small tool and die shop to become a leading eastern producer of screw machine products and metal stampings. In 1950 Steinen entered the oil heating industry with the introduction to the commercial market of an oil burner nozzle.

▶ A group of Minneapolis-St. Paul business and financial executives has purchased controlling interest in *WATERMAN-WATERBURY CO.* Initial public announcement from the new majority stockholders indicated their first long range goal will be to double the company's production within three years.

▶ The name of *UNION CARBIDE AND CARBON CORP.* has been shortened to *UNION CARBIDE CORP.*, the company has announced. Names of divisions of Union Carbide have also been changed. *CARBIDE AND CARBON CHEMICALS CO.* has become *UNION CARBIDE CHEMICALS CO.*, and *LINDE AIR PRODUCTS CO.* is changing its name to *LINDE CO.*

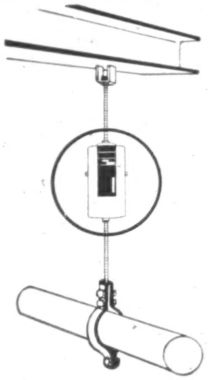
▶ *DONALD M. MAYNE* has announced the formation of a new marketing consulting firm specializing in gas air conditioning. Mr. Mayne said the new firm's services to the gas industry would include marketing, organization, training programs, procedures and related areas of business. Headquarters of the firm will be at 4321 Shenandoah, Dallas.

▶ Employees of *WATER SERVICE LABORATORIES, INC.* celebrated the firm's 30th anniversary at a dinner held at the Park Sheraton Hotel in New York recently.

▶ *MINNESOTA RUBBER & GASKET CO.* has acquired the assets of General Industrial Products Co., Inc., and will operate the firm as a division. The new division, to be known as *MINNESOTA LATEX RUB-*

"WITCH"

PIPE HANGERS
FOR
HEATING – PLUMBING POWER & PROCESS



- Rugged
- Compact
- Simple in design and installation
- Indispensable for systems operating at changing temperatures

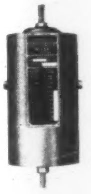


FIG. 401

SPRING HANGER

Our catalogue illustrates a *complete* line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

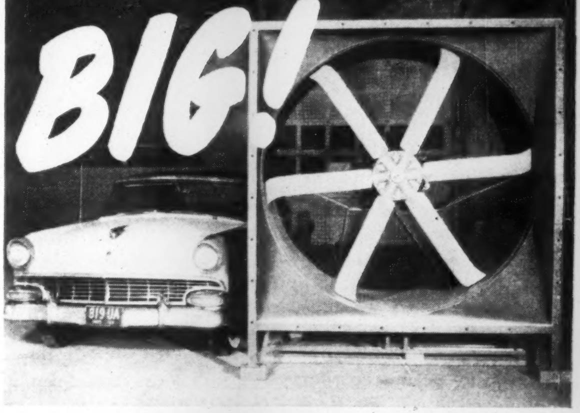
"WITCH"
PIPE HANGERS AND SUPPORTS

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

Aerovent builds 'em



"WE BUILD THE FANS TO FIT YOUR PLANS!"

Yes . . . in Duct Fans, as in all types of air-moving equipment, Aerovent offers a size for every standard industrial installation (and special applications to order).

Illustrated above is a huge 84" Duct Ean . . . one of 24 built by Aerovent for The Consolidated Edison Company for installation in its Arthur Kill and Astoria Generating Stations. These fans, with 20 H.P. motors turning 580 RPM, move air against resistance at the rate of 100,000 CFM. Other Aerovent units are available in sizes from 12" to 96" for capacities to 145,000 CFM.

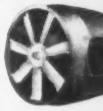
Aerovent Duct Fans . . . direct-driven for standard applications or belt-driven for conditions requiring motor outside airstream . . . may be ordered with special duty motors, alloy propellers and special protective coatings for extreme temperature, moisture or corrosive conditions.

WRITE FOR FREE BULLETIN No. 151

DUCT FANS FOR ALL INDUSTRIAL REQUIREMENTS

Direct-Driven Duct
For installations which permit connection of entire fan assembly in air-stream. For vertical or horizontal use. 12" to 96".

Belt-Driven Duct
Used for corrosive or high-temperature conditions, which require motor to be outside airstream. 2, 4, 6 or 7 blades. 12" to 96".



"Bi-Flo" Duct
For pressures in the 1½" to 4½" range. New 7-blade "Macheta" Airfoil Propellers move more air with lower horsepower. 18" to 48".

***"EFFICIENCY-ENGINEERED"* equipment for every air-handling problem!**

Aerovent FANS

Rated in accordance with Standard Test Code and U.S.D.C. Comm. Std. CS178-51.

Certified Ratings

Aerovent FAN CO. INC.

Ash and Branch Sts
Piqua, Ohio

WE HEAR THAT

Continued

BER CO., will include the original company's two plants in Minneapolis.

▶ *W.H. & L.D. BETZ* has changed the structure of its organization from a partnership to a corporation. At the same time it has changed its name to *BETZ LABORATORIES, INC.* The action was taken to provide greater stability to the organization, the company says.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.* has begun construction of a new administrative office in Allen Park, a Detroit suburb. The one-story, 24,000 sq ft structure will be located on an 8 acre site. An additional 7000 sq ft building will be erected to house research and development activities, the company reports.

▶ Purchase from *GENERAL ELECTRIC CO.* of its line of dewpoint recorders and indicators has been announced by *WEIGHING & CONTROL COMPONENTS, INC.* The acquisition includes design and manufacturing rights, special tooling and parts inventory.

▶ *MILTON ROY CO.* has started construction on an 18,000 sq ft plant in St. Petersburg, Fla. To be completed by early summer, the facility marks the second major step in the company's long range expansion plans and will replace the present "pilot operation" in Gulfport, Fla., started in 1953.

▶ *E. F. EDWARDS*, midwest district manager of *YORK CORP.*, has resigned to become president of his own firm, *E. F. EDWARDS CO.*, an independent franchised associate of York. The Edwards firm will sell, install and service the entire York line in eastern Missouri and southern Illinois.

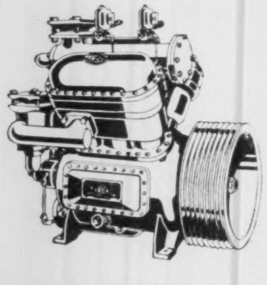
▶ *INTERNATIONAL NICKEL CO., INC.* has established 21 post graduate fellowships in its program for aid to higher education. Ten of the fellowships are for fundamental research in science and 11 are for post graduate preparation for careers in the teaching of the sciences and mathematics.

▶ *FRANK W. REINHART*, chief of the plastics section, National Bureau of Standards, has been awarded the Department of Commerce Silver Medal for Meritorious Service. The award recognized his "major contributions to the science and technology of plastics, and for highly distinguished authorship."

TRADE FRICK MARK®

Air Conditioning
Serves Throughout
this Unique Hotel

CLAYPOOL HOTEL



Nine Frick "ECLIPSE" Compressors Air-Condition the Claypool Hotel at Indianapolis

Famed as the first COMPLETELY air-conditioned large hotel north of the Mason-Dixon Line, the Claypool at Indianapolis selected Frick equipment because it had used Frick Refrigeration for food service since 1939.

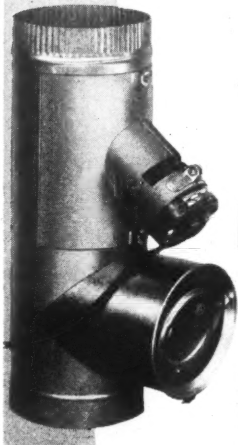
Nine Frick "ECLIPSE" compressors, installed by Decker and Roberts of Fort Worth, carry the air conditioning load, which is divided into three systems.

You get the utmost in air conditioning, ice making, quick freezing and other cooling services when you specify "Frick." Let us quote now on your commercial or industrial cooling needs.

FRICK COMPANY • WAYNESBORO, PENNA.

TWO GOOD REASONS It Pays to Always Buy

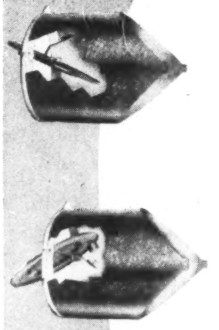
WALKER FUEL-SAVER
AUTOMATIC DRAFT REGULATOR



WALKER

SHUR-FLO DRAFT INDUCER

Recommended for oil- and coal-fired jobs that don't draw well, and gas jobs that don't vent positively. Eliminates need for unsightly chimney extension and for separate installations by combining fan operated inducer with draft regulator control. Installs easily at any angle. You'll save time and money with the Walker Shur-Flo.



WALKER

BBG DOUBLE SWING CONTROL

Provides extremely accurate combustion control in gas-fired equipment. Regulates updraft, dissipates downdrafts. Unique regulator vane swings inward to maintain updraft control; swings outward to provide automatic downdraft venting. Adjustable for any draft intensity required. Enclosed lever action gives positive performance—no chain to foul up.

Clip and mail coupon below for complete information on Walker Draft Control Products.

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CANADIAN DISTRIBUTORS

G. Mitchell & Co., 4215 Gascon St., Montreal, Quebec, Canada

E. H. Price, Ltd., McArthur St., Winnipeg, Manitoba, Canada

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C

EASTERN OIL HEAT EXPOSITION STATLER HOTEL — BOSTON JUNE 4-7, 1957, BOOTH NO. 246

Please rush me information on the Walker items checked:

☐ Double-Swing Draft Control for gas.
☐ Automatic Draft Regulators for small installations.
☐ Industrial Draft Regulators for schools, buildings, plants.
☐ Walker SHUR-FLO Draft Inducer.
☐ Royal Purple-Deluxe Controls for Deluxe Equipment.
☐ Venturi Top Chimney Cap.

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CITY________________ STATE________

It's time for a *Change!*

"Substitute" heating and cooling systems are outmoded

Why continue to use 'substitute' heating and cooling methods when nature's own method of direct radiation is now available in a form that meets all practical demands for structural installation, mechanical operation and control?

Because it heats and cools man while indoors as nature intended, the Burgess-Manning Ceiling for radiant heating and cooling—combined with a third comfort factor of efficient sound conditioning—outmodes every other heating and cooling system that depends on air as the heat exchange medium.

If you are interested in equipping your buildings to provide maximum thermal comfort for the occupants, at substantially lower operating costs, get the full story on the Burgess-Manning Ceiling.

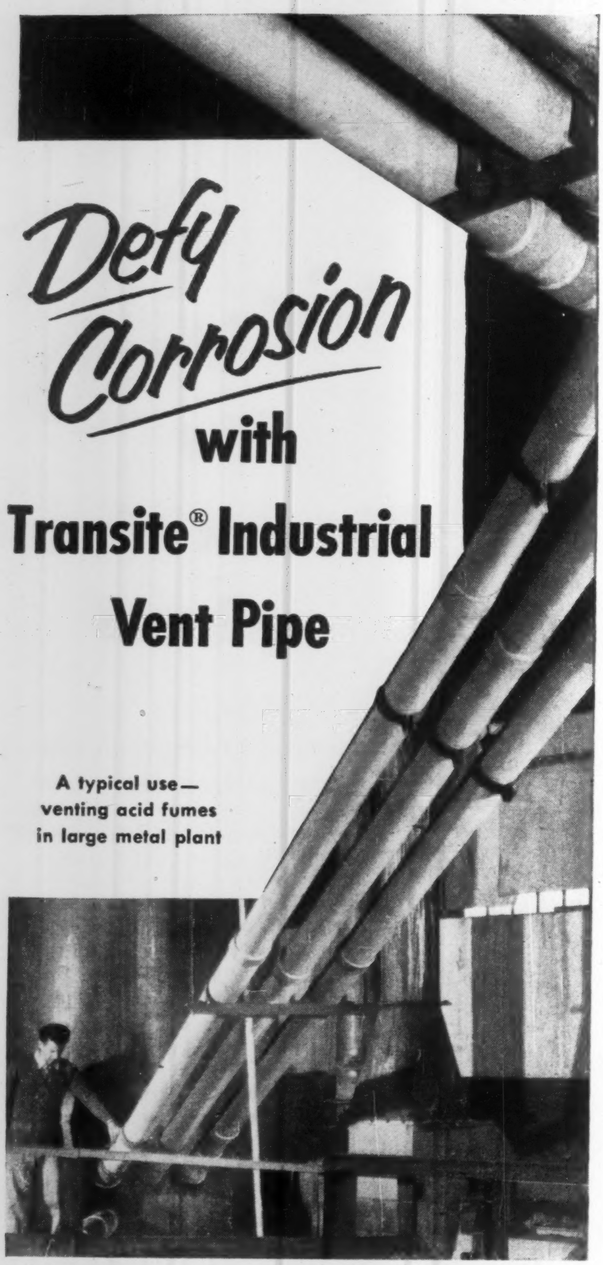
Ask for Catalog A-138-H.

Architectural Products Division of

BURGESS-MANNING COMPANY

5970 Northwest Highway, Chicago 31, Ill.

Manufacturers of 3-Way Functional Ceilings and Acousti-Booths for Telephoning



In severe venting services, Transite's outstanding performance is a matter of record. Made of asbestos and cement, two of nature's most indestructible materials, it resists the attack of most fumes, vapors, and dusts.

Installed indoors or out, Transite Industrial Vent Pipe can't rust or rot, never needs paint, nor other protective coating. Wide variety of fittings makes it adaptable to any layout. For more information, write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

Johns-Manville
TRANSITE INDUSTRIAL VENT PIPE
An Asbestos-Cement Product

WE HEAR THAT

Continued

▶ *H. B. FULLER CO.* has moved to a new manufacturing plant located between St. Paul and Minneapolis. The structure houses offices, new production equipment and modern laboratory testing facilities, the company reports.

▶ Prompted by an increasing industrial demand for "low temperature welding alloys" in the western states, *EUTECTIC WELDING ALLOYS CORP.* has established two new warehouse-service centers in that area since the first of the year. Phoenix, Ariz., and Huron, S.D., are the sites of the facilities opened in January and February, respectively.

▶ The first service course offered at the new *AMERICAN BLOWER* commercial air conditioning training school was filled by representatives of *HAJOCA CORP.*, eastern heating and air conditioning distributor. The school is located in American Blower's main plant at Dearborn, Mich.

▶ *ROBERTSHAW-FULTON CONTROLS CO.* will soon begin construction of a $250,000 western research center at Anaheim, Calif., the company reports. The new facility will be located on a 5 acre site and will have 15,000 sq ft of floor space.

▶ *KENCO PUMP DIV., AMERICAN CRUCIBLE PRODUCTS CO.* will soon be situated in a new plant in Lorain, O. The structure consists of 12,000 sq ft of floor space and is headquarters for the division's design, administration, manufacturing, engineering, service, warehousing, shipping and sales facilities.

▶ The first of a series of 17 *WORTHINGTON CORP.* air conditioning and refrigeration field service meetings was held recently in Atlanta. Similar meetings are being held throughout the country, the company reports.

▶ *NYLOK CORP.* has licensed *LAMSON & SESSIONS CO.* to produce its line of self locking screws and bolts. Initially, L&S will start production of Nylok fasteners in its main Cleveland plant.

▶ A traveling service school to supplement its annual service school program has been set up by *ORR & SEMBOWER, INC. THEODORE SCHLADITZ*, previously manager of the service department, has been appointed to head up the new operation. During the year he will visit the company's representatives on a

NOW READY...

A NEW
BULLETIN ON
quiet-operating
CENTRIFUGAL
ROOF
EXHAUSTERS

PENN DYNAFANS
PENN VENTILATOR CO.

featuring
PENN DYNAFANS

WITH LOW VELOCITY WHEEL DESIGN

Expressly suited for schools, hospitals, public and commercial buildings where sound levels must be held to a minimum.

Your copy of Penn's new 8-page catalog, Bulletin PD-42 is now available. Contact the Penn Ventilator man in your area or write direct to get the complete story on the leading fully-housed centrifugal roof exhauster.

PENN VENTILATOR CO.
PHILADELPHIA 40, PA.
Right on top . . . for more than 30 years!

IN CANADA: Toronto: Control & Metering, Ltd.
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Montreal: Air-Care, Ltd.
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OVER 400
BURNERS
REPLACED WITH
THIS
FUEL
SAVER

LO-BLAST
ECONOMITE
POWER GAS CONVERSION BURNER

In the small home development of 472 homes in Marquette Heights, near Peoria, Illinois, illustrated above, Lo-BLAST Economite Power Gas Burners replaced oil burners originally installed. The reasons are evident when the trouble-free performance and economy of the Economite are considered.

Power burner design assures perfect combustion, regardless of natural draft conditions—*saves an average of 10% in fuel*—ideal for down-draft heating plants. The Economite burns so smoothly you can't tell when it's running.

Every Economite is factory-tested on gas and shipped assembled, fully equipped with fool-proof safetys.

Lo-BLAST Power Gas Burners are available in capacities from 70,000 to 20,000,000 BTU input. Write for literature.

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

FLAME
COMBUSTION EQUIPMENT
ENGINEERED By.....THE WEBSTER ENGINEERING COMPANY
RETENTION

COMBUSTION with SAFETY

Unparalled safety is but one of the features of WEBSTER'S revolutionary non-premixing ring gas burner incorporating flame retention regardless of air velocity.

Factory assembled Forced Draft Series H packaged units are available for Gas, Rotary Oil or Combination. Other variations soon to be available.

Write for Series B13 literature.

Some Territories Open

The WEBSTER ENGINEERING Company
TULSA 16, OKLAHOMA

Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

WE HEAR THAT

Continued

regular schedule and bring them the latest information and instructions from the firm's engineering and service departments.

▶ How almost 8 in. of insulation value can now be achieved in roofs and ceilings in summer with but two layers of aluminum and one of fiber, properly air-spaced, was explained in a lecture before the Princeton School of Architecture by *ALEXANDER SCHWARTZ*, president of *INFRA INSULATION, INC.*

▶ An expansion and modernization program running to over half a million dollars has been started by *BURNHAM CORP.* in Lancaster, Pa., the company announces. The project includes erection of a new building comprising 40,000 sq ft of additional plant area, the installation of modern mechanized molding equipment and improved production facilities in the existing foundry department. It is expected that the new building will be completed by fall of this year.

▶ *AIR REDUCTION SALES CO.* will build a multimillion dollar air liquefaction plant for the production of liquid oxygen, nitrogen and argon at Acton, Mass., the company announces. The facility, which is scheduled for completion during the summer of 1958, will be designed to produce 75 tons of liquefied gases per day.

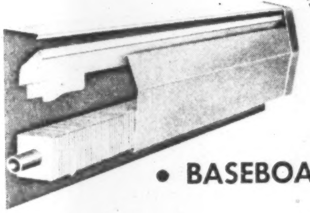
▶ *ILLINOIS TOOL WORKS* has sold its power saw blade division to *E. H. WACHS CO.* Wachs will market the metal cutting tools produced by its newly acquired division under its "Guillotine" tradename.

▶ The opening of a new East Coast assembly plant has been announced by *DOVER MFG. CO.* The structure is located in Greensboro, N.C., and will have warehousing and shipping facilities in addition to an assembly line.

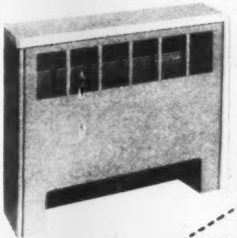
▶ *JOHNSON SERVICE CO.* has moved its Louisville office to 2251 S. Shelby St. Its former location was 1406 Heyburn Bldg.

▶ More than 3700 employees benefited by on-the-job training at *CARRIER CORP.* last year, company officials announce. This means that nearly one-third of Carrier's employees received some form of on-the-job training. Courses ranged from apprentice training to special courses for superintendents and other executives. ╪

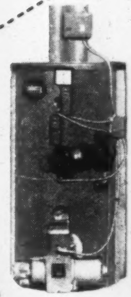
HEATING EQUIPMENT BY EMBASSY



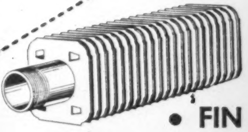
- BASEBOARD



- CONVECTORS



- BOILERS



- FIN TUBE

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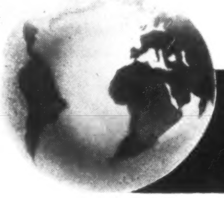

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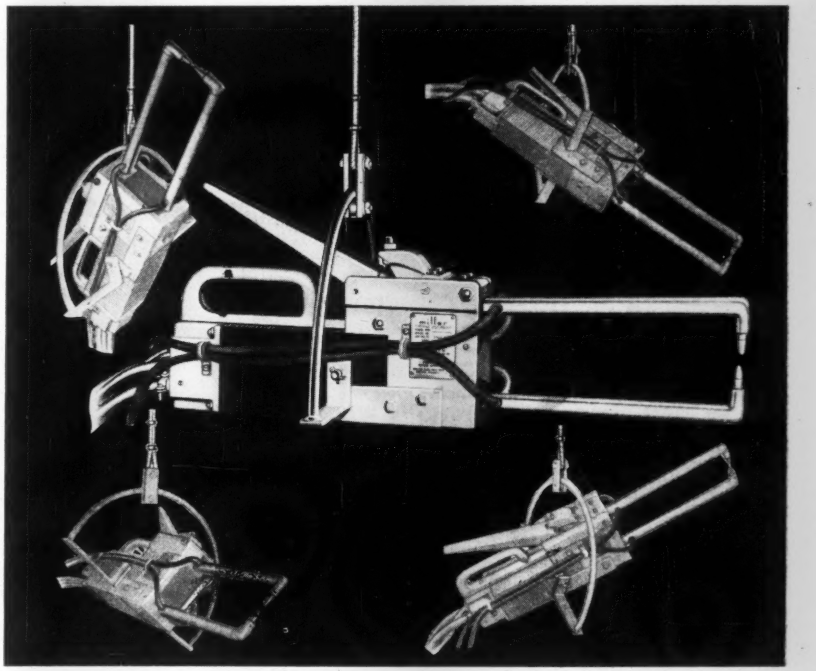

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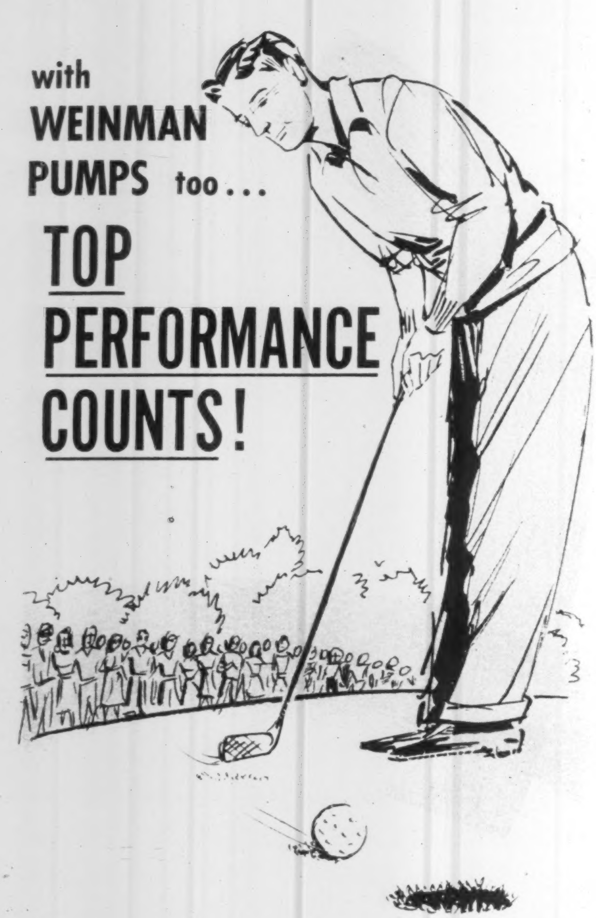

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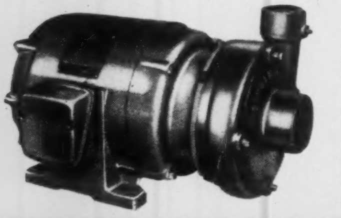

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JUNE 13-15—*Third National Symposium on Instrumental Methods of Analysis and Analytical Instruments Clinic*. University of Chicago. Chicago. Sponsored by Instrument Society of America. Information: H. S. Kindler. director of technical programs. ISA. 313 Sixth Ave.. Pittsburgh 22.

JUNE 16-21—*American Society for Testing Materials*. Chalfonte-Haddon Hall. Atlantic City. ASTM headquarters: 1916 Race St.. Philadelphia 3.

JUNE 24-26—*American Society of Heating and Air-Conditioning Engineers. Inc.*. semi-annual meeting. Manoir Richelieu. Murray Bay. Quebec. Information: A. V. Hutchinson. executive secretary. ASHAE. 62 Worth St.. New York 13. (See page 172.)

AUG. 11-15—*First National Conference on Applied Heat Transfer*. Pennsylvania State University. University Park. Pa. Sponsored by heat transfer division and central Pennsylvania section of American Society of Mechanical Engineers in cooperation with College of Engineering and Architecture of the University. ASME headquarters: 29 W. 39th St.. New York 18.

AUG. 26-28—*Gas Dynamics Symposium*. Technological Institute. Northwestern University. Evanston. Ill. Information: Dr. Ali Bulent Cambel. Gas Dynamics Laboratory. Northwestern University. Evanston. Ill.

SEPT. 9-13—*12th Annual Instrument Automation Conference and Exhibit*. Cleveland Auditorium. Cleveland. Sponsored by Instrument Society of America. 313 Sixth Ave.. Pittsburgh 22. Exhibit information: Fred J. Tabery. 3443 S. Hill St.. Los Angeles.

SEPT. 13-14—*Associated Insulation Contractors of the Western States*. 16th annual meeting. El Coronado Hotel. San Diego. Information: Insulation Distributor-Contractors National Association. Inc.. 1632 K St.. N.W.. Washington. D.C.

SEPT. 17-20—*Insulation Distributor-Contractors National Association, Inc.*, second annual convention. St. Francis Hotel. San Francisco. Information: IDCNA. 1632 K St.. N. W.. Washington. D. C.

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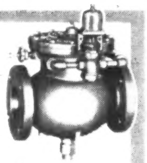

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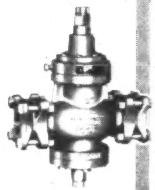

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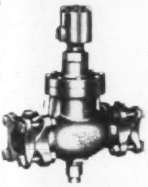

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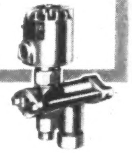

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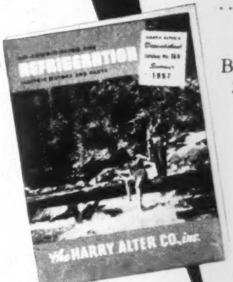

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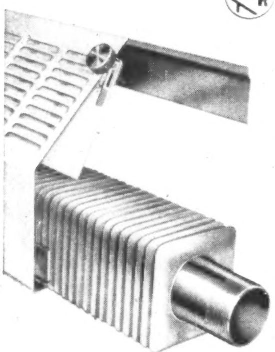

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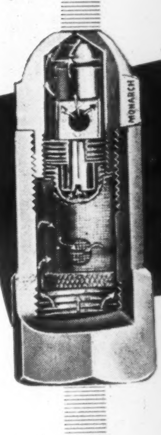

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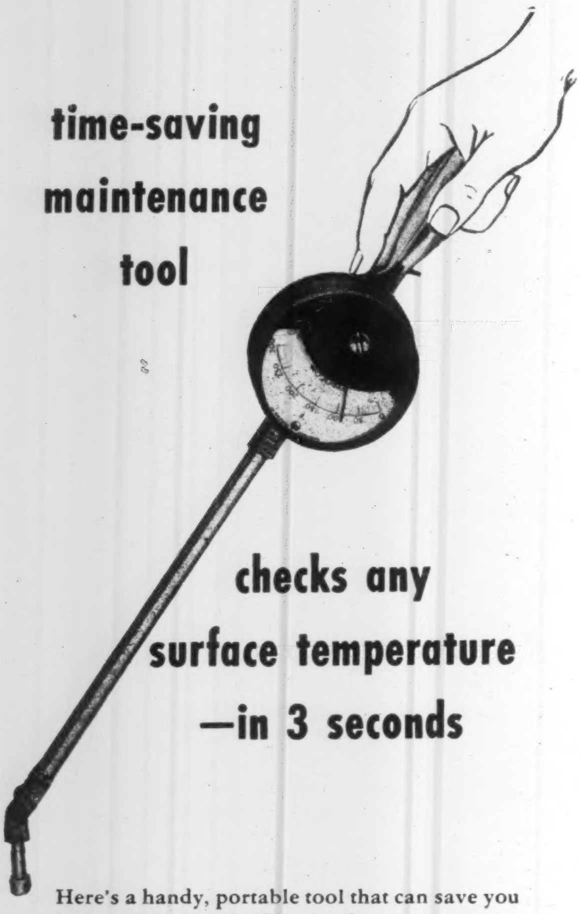

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OCT. 1-4—*National Association of Corrosion Engineers*, south central regional meeting. Oklahoma City. NACE headquarters. 1061 M & M Bldg., Houston 2.

OCT. 6-8—*Fluid Control Institute*. Westchester Country Club, Rye, N. Y. Information. Fluid Control Institute, Inc., P. O. Box 191, Decatur, Ill.

OCT. 7-9—*American Gas Association*, annual convention. Kiel Auditorium, St. Louis. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 22-24—*National Association of Corrosion Engineers*, seventh annual western regional conference. San Diego. Information: NACE, 1061 M & M Bldg., Houston 2.

NOV. 12-14—*National Association of Corrosion Engineers*, northeast regional meeting. Pittsburgh. NACE headquarters: 1061 M & M Bldg., Houston 2.

NOV. 13-14—*Air Pollution Conference*. Chicago. Cosponsored by Armour Research Foundation and Midwestern Air Pollution Prevention Association. Information: Conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16.

NOV. 14-16—*American Society of Refrigerating Engineers*, semi-annual meeting. Chicago. ASRE headquarters: 234 Fifth Ave., New York.

NOV. 18-21—*10th Exposition of the Air-Conditioning and Refrigeration Industry*. International Amphitheater, Chicago. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

NOV. 18-22—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Morrison Hotel, Chicago. NWAHACA headquarters: 640 Engineers Bldg., Cleveland 14.

JAN. 27-29, 1958—*American Society of Heating and Air-Conditioning Engineers, Inc.*, 64th annual meeting. Pittsburgh. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

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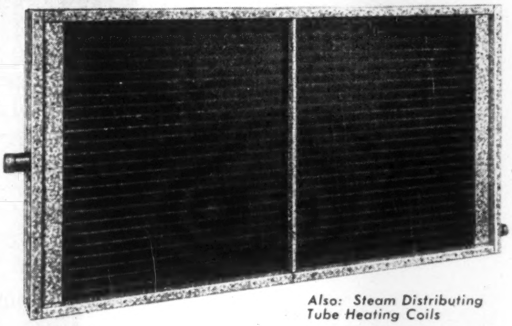

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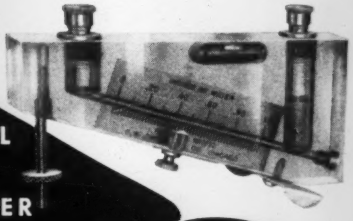

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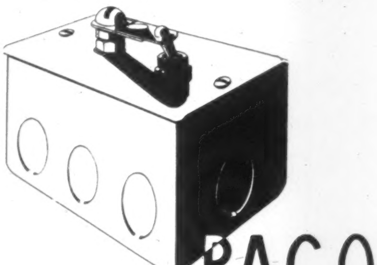

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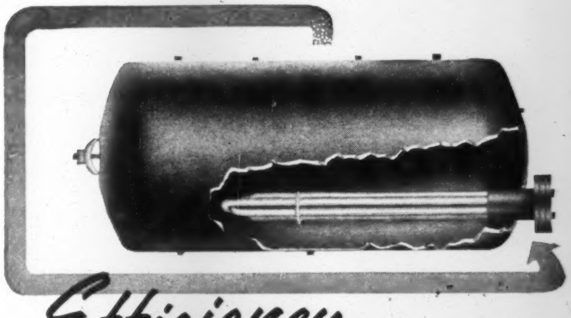

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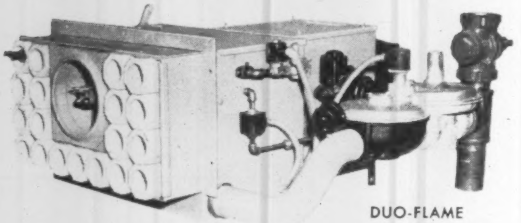

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Basic Building Code of the Building Officials Conference of America, Inc.—1955 Ed. 400 pp. (Supplements Nos. 1 and 2. 16 pp., also available.) Building Officials Conference of America, Inc., 110 E. 42nd St., New York 17.

High Pressure Technology—By Edward W. Comings. 572 pp. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. $11.50.

"Everybody Talks About the Weather—Now Look What You Can Do About It"—16-page booklet. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C. 10c.

Structural Chemistry and Metallurgy of Copper—By D. K. Crampton. 28 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $1.50.

Industrial Hygiene Foundation Activities—21 pp. Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. Free.

Proceedings of the 20th Anniversary Time and Motion Study and Management Clinic—112 pp. Industrial Management Society, 35 E. Wacker Dr., Chicago 1. $5.00. #

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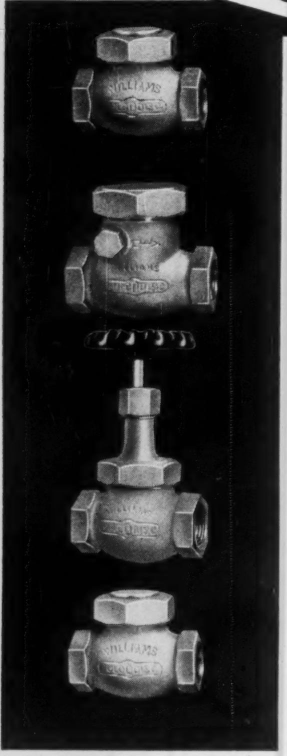

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Vulcanized asbestos disc. For 200 lbs. working steam pressure at 500° F. or 400 lbs. working non-shock gas and liquid pressure at 150° F. Installed in horizontal or vertical position. Screw cap and screw ends.

No. 912 "Vulcodisc" Globe Valve

May be used for steam or hot water with pressures to 200 lbs., temperatures to 500° F.; or water, gas and air to 400 lbs. at 150° F.; for oil to 200 lbs. pressure at 250° F.

No. 833 Horizontal Check Valve

Renewable composition, air disc, integral seat, screw ends, spring loaded disc. 300 lbs. working non-shock gas and liquid pressure at 150° F.

These valves meet all government, marine and industrial specifications.

Bridgeport 1,
Connecticut

DETROIT CONTROLS
CORPORATION
Division of AMERICAN-Standard

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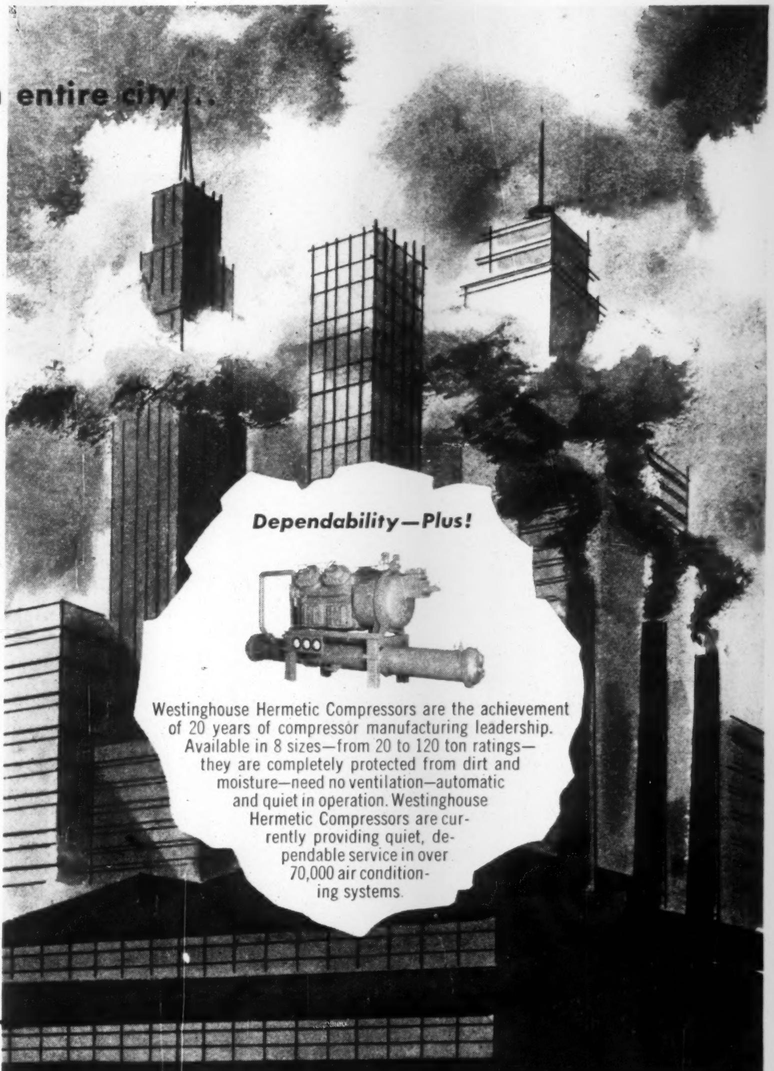
For one building or an entire city...

Westinghouse

AIR CONDITIONING MEETS YOUR SPECIFICATIONS!

Regardless of size, location, or type of building, Westinghouse Air Conditioning meets any job requirement. You have UNLIMITED FREEDOM of system choice and equipment application with Westinghouse Air Conditioning.

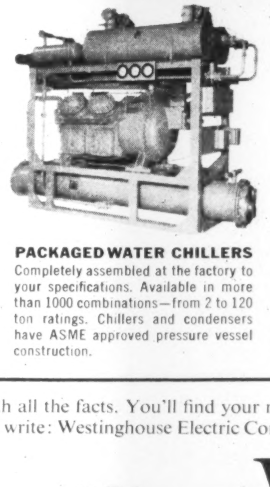
Westinghouse has a quarter-century of experience and leadership in the manufacture of a full-line of Hermetic Compressors, Condensers and Factory-Assembled Packaged Systems. There is a complete selection of components to meet every air conditioning need in commercial or industrial application—all built to exacting quality standards.



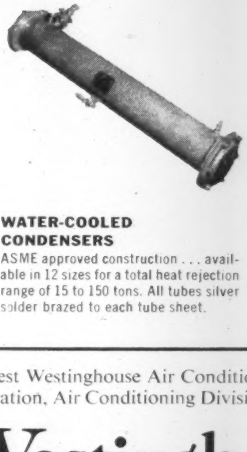
Dependability—Plus!

Westinghouse Hermetic Compressors are the achievement of 20 years of compressor manufacturing leadership. Available in 8 sizes—from 20 to 120 ton ratings—they are completely protected from dirt and moisture—need no ventilation—automatic and quiet in operation. Westinghouse Hermetic Compressors are currently providing quiet, dependable service in over 70,000 air conditioning systems.

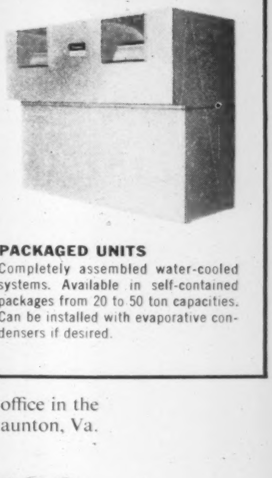
EVAPORATIVE CONDENSERS
Job-proven through the years . . . available in 9 sizes covering a range of 20 to 150 tons. Superior construction with casing hot-dip galvanized after fabrication.



PACKAGED WATER CHILLERS
Completely assembled at the factory to your specifications. Available in more than 1000 combinations—from 2 to 120 ton ratings. Chillers and condensers have ASME approved pressure vessel construction.



WATER-COOLED CONDENSERS
ASME approved construction . . . available in 12 sizes for a total heat rejection range of 15 to 150 tons. All tubes silver solder brazed to each tube sheet.



PACKAGED UNITS
Completely assembled water-cooled systems. Available in self-contained packages from 20 to 50 ton capacities. Can be installed with evaporative condensers if desired.

J-80548A

Call the man with all the facts. You'll find your nearest Westinghouse Air Conditioning office in the Yellow Pages, or write: Westinghouse Electric Corporation, Air Conditioning Division, Staunton, Va.

YOU CAN BE SURE... IF IT'S Westinghouse

SELF-CLEANING STRAINERS

PIPE LINE STRAINERS

SIZES - TYPES FOR ALL SERVICES

Mueller self-cleaning pipe line strainers are inexpensive protection for valves, meters, pumps, etc. Immediate delivery—all sizes from 1/4" through 16" in stock. Use this low cost form of insurance in all your installations.

Write for bulletin AM giving complete data, prices, specifications, etc.

Mueller

STEAM SPECIALTY COMPANY, INC. 40-20 22nd St., Long Island City, 1, N.Y.

for

SPECIFICATION *and* BUYING INFORMATION

Use your complete, up-to-date

JANUARY DIRECTORY ISSUE

Your job will be a lot easier if you'll keep the January Directory issue of Heating, Piping & Air Conditioning constantly available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes the pumps, valves, traps, compressors, specialties of all kinds, etc., you need — and where they're located. They're identified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference. Keep it handy . . . it's a time saver.

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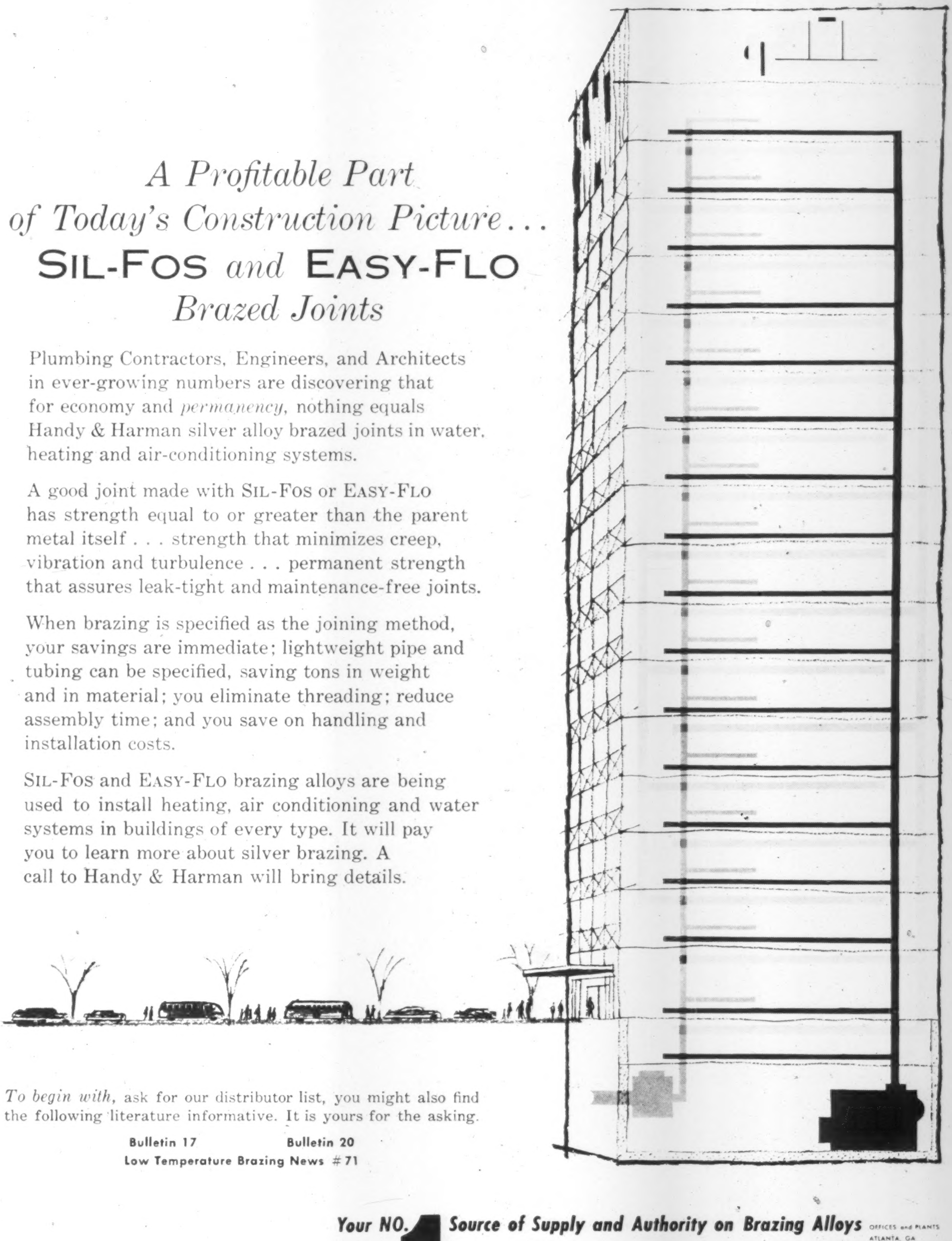
A Profitable Part of Today's Construction Picture... SIL-FOS *and* EASY-FLO *Brazed Joints*

Plumbing Contractors, Engineers, and Architects in ever-growing numbers are discovering that for economy and *permanency,* nothing equals Handy & Harman silver alloy brazed joints in water, heating and air-conditioning systems.

A good joint made with SIL-FOS or EASY-FLO has strength equal to or greater than the parent metal itself . . . strength that minimizes creep, vibration and turbulence . . . permanent strength that assures leak-tight and maintenance-free joints.

When brazing is specified as the joining method, your savings are immediate; lightweight pipe and tubing can be specified, saving tons in weight and in material; you eliminate threading; reduce assembly time; and you save on handling and installation costs.

SIL-FOS and EASY-FLO brazing alloys are being used to install heating, air conditioning and water systems in buildings of every type. It will pay you to learn more about silver brazing. A call to Handy & Harman will bring details.



To begin with, ask for our distributor list, you might also find the following literature informative. It is yours for the asking.

Bulletin 17 **Bulletin 20**
Low Temperature Brazing News #71

Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN
General Offices: 82 Fulton St., New York 38, N. Y.
DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES and PLANTS
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CHICAGO, ILL
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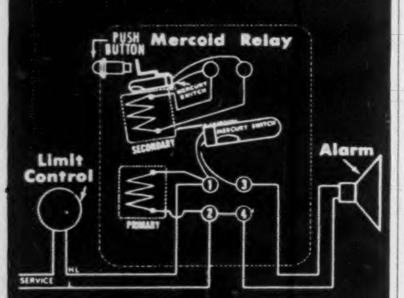
DETROIT, MICH
LOS ANGELES, CALIF
OAKLAND, CALIF
TORONTO, CANADA
MONTREAL, CANADA

MERCOID®
MERCURY SWITCH EQUIPPED
RELAY

for Audible or Visual Alarm



The control which senses the alarm circuit is connected in series with the primary coil of the relay. The alarm control closes its circuit to supply current to the relay primary coil and through the normally closed mercury switch of the relay to the Audible or Visual Alarm. Pushing the manual button of the relay (or through a momentary contact by a remote switch connected to the pilot circuit) causes the secondary coil to move upward, opening the normally closed mercury switch and stopping the Alarm. A lock circuit in the relay holds the alarm circuit open as long as current is supplied to the primary coil of the relay. When the alarm control opens its circuit interrupting the current to the relay primary coil, the magnetic repulsion holding the relay secondary coil up is interrupted and the secondary coil drops from its own weight. The alarm circuit sequence is thus reestablished automatically and is ready for another operation at the demand of the alarm control.

Available for 115, 230 or 440V. A.C. current or similar D.C. voltages.

Our engineers are at your service— send in your control problem or

WRITE FOR BULLETIN CA-8R

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

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ATTENTION MINNEAPOLIS!

Twin Citian rubs Mr. Entropy* out— stops steam waste with SELECTOTHERM

Around Minneapolis, Ed Uhl, 128 South Tenth Street, is the No. 1 exterminator of steam waste in schools and other buildings where boilers are used for steam heating.

He does it with SELECTOTHERM, the high-vacuum heating system that automatically provides steam at the proper pressure and temperature for perfect comfort. Installation records show that SELECTOTHERM cuts the fuel bill 19% or more—*enough to pay for the system within five years!*

SELECTOTHERM applies the control directly to the boiler, adds to the effectiveness of unit ventilators and individual room control. Get the whole story. If you're from the Twin City area, call Ed at Uhl Company, Inc. (FEderal 3-7247). If not, write for fact-filled SELECTOTHERM booklet, *Boiler Room Ballad.*

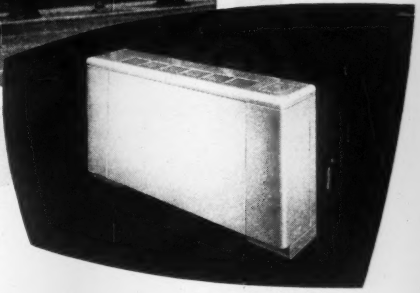
**Mr. Entropy represents the heat that is produced but unavailable for use.*

SELECTOTHERM
HEATING CONTROL SYSTEM ®

A product of Illinois Engineering Co.
Division of American Air Filter Co., Inc.
2035 South Racine Ave., Chicago 8, Illinois

ANOTHER CONSULTING-ENGINEER-APPROVED QUALITY AIR CONDITIONING JOB BY MARLO

LANIER & LEVY
APPROVED
WASHINGTON, D. C.
AND NEW YORK CITY



261 *Marlo* "SEAZONAIRES" air condition Luxurious New Washington Apartments

Here is urban living at its most luxurious—a handsome apartment building only five minutes from the heart of the nation's capital, with every facility for the utmost in comfort and convenience.

And for this superb dwelling, consulting engineers Lanier and Levy specified Marlo Seazonaire Room Air Conditioning Units—Remote Type, Free Standing Style. 261 of these compact, stylish units —smartly designed to harmonize with modern interiors—permit tenants to regulate temperatures to suit their own preference.

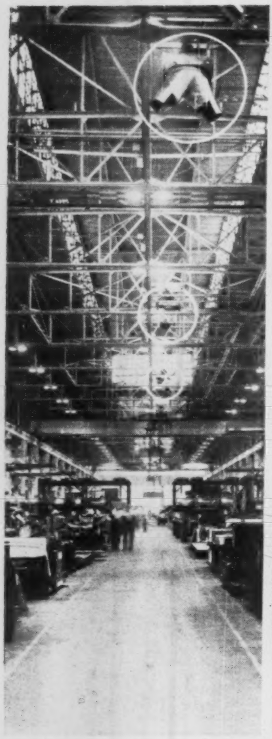
Owned by Dr. Jacob Kotz, this new apartment project was designed by Edwin Weihe, and built by the Cafritz Construction Co. Mechanical Contractor was Harry E. Nau and Co., Inc.

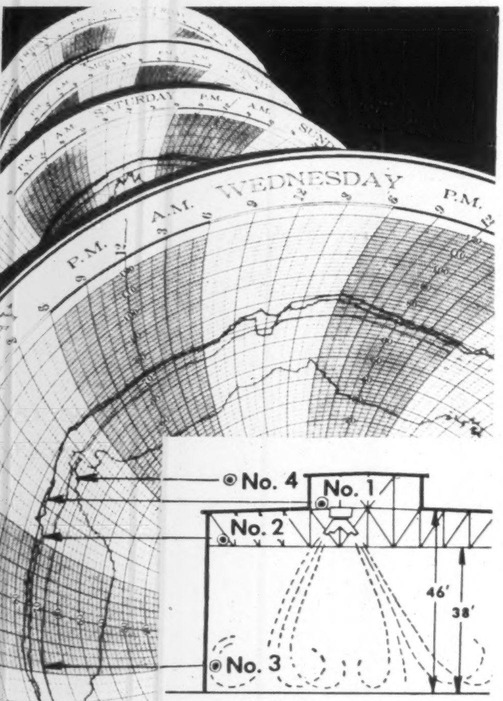
Write today for complete information about the advantages of quality air conditioning by Marlo.

MARLO coil co.

SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925





BUILDING AREA (3 Bays)
Total 625' x 240'

RECORDED TEMPERATURE READINGS PROVE THE HEATING EFFICIENCY OF WING REVOLVING UNIT HEATERS

Effectiveness of Revolving Distributors is shown by Low Temperature Differential between Roof and Working Level

When the Budd Company's new plant in Philadelphia was erected, twelve Wing Revolving Unit Heaters with No. 8 Distributor Outlets were selected to heat the plant.

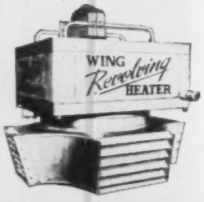
A series of temperature readings between floor and roof was made using a four-point recording thermometer. Over four weekly periods during February, March and April the following averages were recorded.

Bulb No. 1 (in monitor) ...75.5°F.
Bulb No. 2 (in truss chord) ...73°F.
Bulb No. 3 (working level) ...66.5°F.
Bulb No. 4 (outside) ... ranged between 20° and 70°F.

The complete and uniform heating of this plant proves beyond question the ability of Wing Heaters to project heated air to the working level without hot blasts.

In summer with steam turned off, the revolving distributors produce a pleasant, cooling effect.

Mail coupon for bulletin.

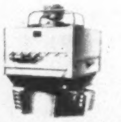


Four designs of revolving distributors are available to suit different ceiling heights. Above, No. 8 for high ceilings; right, No. 5 for low ceilings.

L. J. Wing Mfg. Co.
140 Vreeland Mills Road, Linden, N. J.
Factories: Linden, N.J. and Montreal, Can.
In Europe: WANSON, Haren-Nord, Brussels, Belgium

· Wing ·
REVOLVING HEATERS

WING DRAFT INDUCERS



WING FRESH AIR SUPPLY HEATERS

WING FANS

WING BLOWERS

L. J. Wing Mfg. Co., HP-6
140 Vreeland Mills Rd., Linden, N.J.
Please send copy of Revolving Heater Bulletin HR-6A.
Name..........
Firm..........
Address..........
City.......... Zone...... State..........

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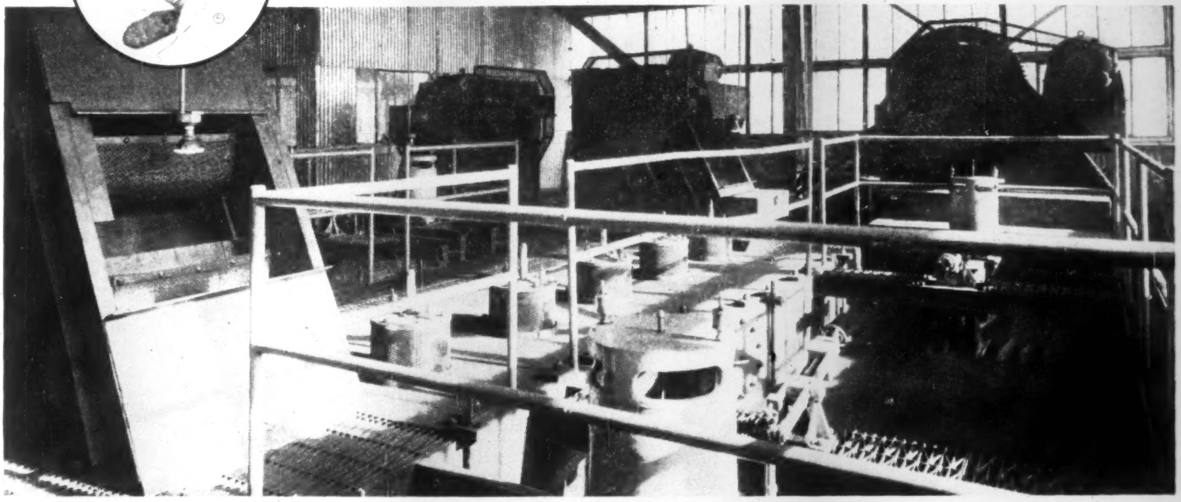
WHY CHESSIE'S RAILWAY IS FIRST IN COAL



SUPERIOR COAL. The entire output of this mine is processed by automatic compound coal cleaning equipment. Producers on the Chesapeake and Ohio are prepared to supply you with highest quality coal of the type best suited to your needs and processed to your own specifications. ●

SUPERIOR SERVICE. To its present fleet of 63,780 coal cars—largest in the world—C & O is adding another 8,000. New high-speed yards, new locomotives and a new teletype car reporting system bring you faster, more dependable service.

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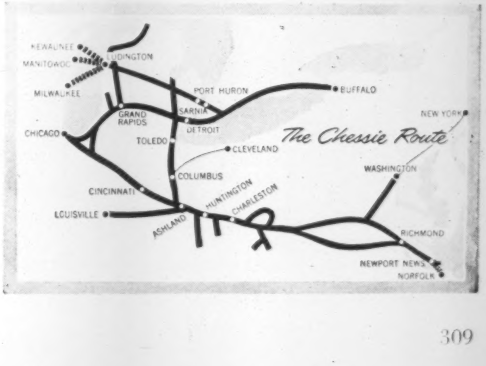
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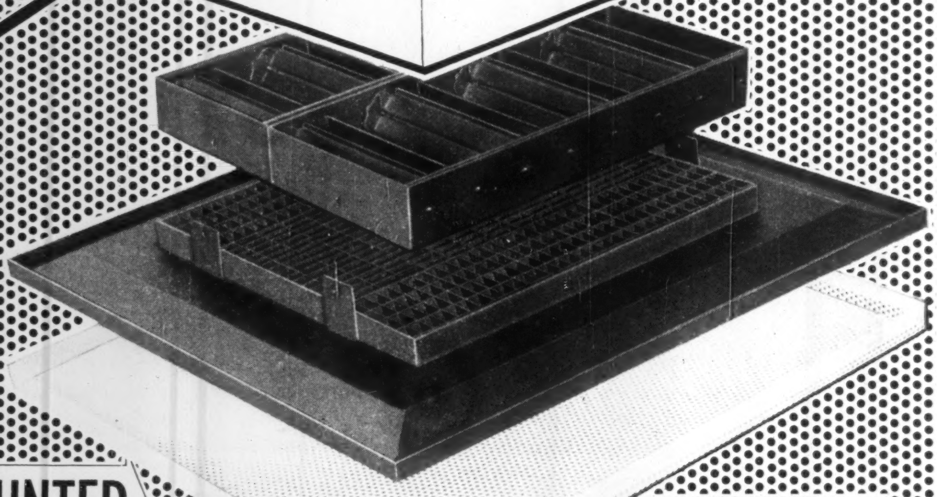
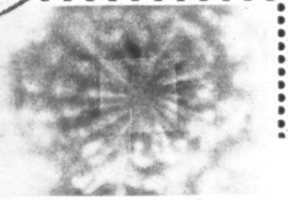


FLUSH MOUNTED AIR DIFFUSERS



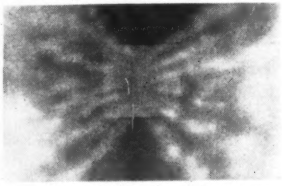
4 Way Diffusion Pattern

ARCHITECTURALLY ADAPTABLE WITHOUT SACRIFICING MECHANICAL REQUIREMENTS

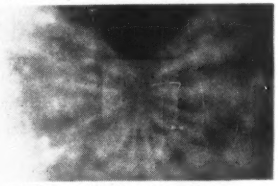
Multi-Orifice, Multi-Jet Air Diffusers have been designed to comply with modern architectural concepts and still provide all of the tried and proven elements of the Air-Factors popular B60 Air Diffuser.

Custom engineered air conditioning systems may be designed with full proportionate air patterns available.

Supply air is discharged into a room substantially paralleling the surface upon which the air diffuser is mounted to produce the maximum in air mixing properties and afford proper circulation for human comfort.



2 Way Diffusion Pattern



3 Way Diffusion Pattern

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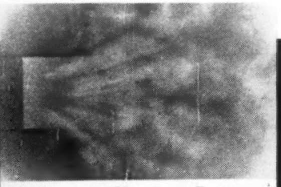

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AIR-FACTORS — MANUFACTURERS OF THE MOST COMPLETE LINE OF AIR DISTRIBUTION EQUIPMENT

970 BEDS
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But despite the fact that old America is solidly united on the need for protecting young America, some hazards, less obscure but no less real than traffic, fire or health dangers, are sometimes overlooked.

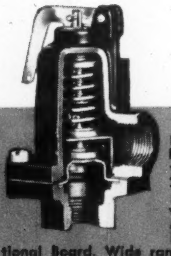
An excellent example is the unprotected heating or power boiler in school buildings. It is the duty of every heating man to point this out to the proper authorites.

No field is more receptive to your counsel. No field offers you a better opportunity to be of real service to your community.

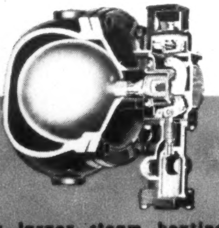
There are McDonnell safety devices for every type and size of heating boiler and hot water plant found in schools, operating at any pressure up to 250 lbs. A number of them are illustrated here. Ask for complete catalog.

McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

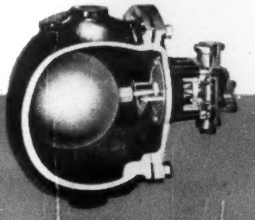


For hot water heating boilers your best bet is the 230 or 240 Series pressure relief valves. They meet ASME Code, are Btu-rated by National Board. Wide range of sizes to answer all needs. McDonnell also offers water feeders and cut-offs for use on hot water heating boilers. For domestic water systems the 230 and 240 Series are available with higher opening pressures.



For larger steam heating boilers—above 5000 sq. ft.; maximum steam pressure, 35 lbs. — use the No. 51-2 feeder and cut-off combination. Other McDonnell combinations available for larger and smaller boilers.

For steam boilers up to 150 lbs. pressure install the No. 150 (shown) pump control, low water fuel cut-off and low water alarm switch. Most widely used control of its kind. No. 157 is same but has integral water column for easy installation.



For condensate receivers use No. 27T Make-up feeder. Teams up with No. 150; maintains minimum supply in receiver to meet any boiler demand for water. Has stainless steel valve and seat for drip-tight closure.

McDONNELL *Boiler Water Level Controls*

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